NZ and the EU in the Pacific: Renewable Energy as a Mechanism for Development

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List of Abbreviations

ACP	African, Caribbean, and Pacific Group of States
ADB	Asian Development Bank
B	Billion
CER	Certified Emission Reduction
CDM	Clean Development Mechanism
CSP	Country Strategy Paper
EC	European Commission
EDF	European Development Fund
EE	Energy Efficiency
EPA	Economic Partnership Agreement
EU	European Union
FF	Fossil Fuel
GCCA	Global Climate Change Alliance
GEF	Global Environment Facility
GHG	Greenhouse Gas
GoT	Government of Tonga
HDI	Human Development Index
IO	International Organisation
IRENA	International Renewable Energy Agency
JCD	Joint Commitment for Development
kWh	Kilowatt Hour
LDC	Least Developed Country

M	Million
MDG	Millennium Development Goal
MW	Megawatt
NZ	New Zealand
NZAID	New Zealand Agency of International Development
NZES	New Zealand Energy Strategy
PIC	Pacific Island Country
PIF	Pacific Islands Forum
PNG	Papua New Guinea
PPP	Public-Private Partnership
PV	Photovoltaic
RE	Renewable Energy
REEEP	Renewable Energy and Energy Efficiency Partnership
SIDS	Small Island Developing States
RSP	Regional Strategy Paper
TERM	Tonga Energy Road Map
TERM IU	Tonga Energy Road Map Implementation Unit
TPL	Tonga Power Limited
UAE	United Arab Emirates
WTO	World Trade Organisation

Chapter One: Introduction

Research Question

What impact would implementation of renewable energies have on development in the Pacific region? What role could NZ and the EU play in this transition?

Methodology

This research will be an evidence based analysis of the costs and benefits of renewable energy (RE) adoption in the Pacific region from a financial, political and societal point of view. The primary goal is to understand whether RE can play a role in Pacific development. A secondary goal is to determine whether New Zealand (NZ) and the European Union (EU), through their ties with the Pacific region, are best placed to be primary drivers of this conversion or if other policy frameworks are more suitable. In order to satisfy these goals, this thesis will first aim to gain a deep understanding of academic work on RE in the developing world with specific emphasis on small island developing states (SIDS) and the Pacific region. Following this, examining the policy that exists in regards to RE within NZ, the EU and the Pacific region will help show its inherent importance to each of these bodies. Investigating policy linkages from NZ and the EU towards Pacific island countries (PIC) and the region as a whole will help delineate how strong relations are and what role both could fill in a transition to RE in the Pacific. This introductory section will include a basic overview of RE relevance in the developing world and in the Pacific context, while the body of this research will provide context and detail through a literature review, policy framework analysis and case study.

The literature review will canvas academic work on RE in the developing world with a progressively narrowing focus. Initially, gaining a broader understanding of the role of energy in development will be important for providing a contextual basis for the study of RE in the developing world. Following this, looking specifically at whether there is economic and social benefit to RE use and what obstacles to implementation

exist in developing countries will help provide part of the answer to the first question, that of the potential impact of RE sources on development. Examining the specific instruments that are currently being utilised for the purposes of RE implementation in the developing world, particularly the widely employed Clean Development Mechanism (CDM), will also be part of this literature review. Understanding how these might be applied to the Pacific region can help further explain what impact RE sources could have in this context and give some basic insight to what role exists for NZ and the EU in this potential implementation process

The policy framework chapter of this thesis will be focussed on better understanding what role NZ and the EU could have in RE implementation in the Pacific region. The first type of policy considered will be NZ and EU internal energy policy, looking specifically at what RE emphasis exists within them. This will help gain a better understanding of the importance both place on RE within their borders and as a political issue generally, which could have an effect on their desire to promote RE use externally. Following on from this, looking at how the Pacific region cooperates politically and what internal energy policy emphasis exists within this framework will help define what internal desire exists for RE sources as a way to help alleviate their energy issues. Most of the rest of this chapter will be dedicated to outlining the NZ-Pacific and EU-Pacific political ties. This will include analysis of agreements that have defined relations in the recent past, how political interaction is undertaken with regards to Pacific development and finally how funding is directed to the region from both a NZ and EU perspective. All of this will include consideration of the importance placed on RE within these relations and whether NZ or the EU looks to drive implementation in their political dealings with the Pacific region. Finally, this section will introduce any new organisations or policy tools that might affect NZ-Pacific or EU-Pacific relations with regards to RE in the future. By encapsulating all of this political documentation and dialogue, this chapter should be able to contribute to answering the question of what role NZ and the EU could play in RE implementation in the Pacific region.

The case study chosen will bring both the theoretical and political elements of RE implementation together and show how the benefits and obstacles manifest themselves in a real world context. The initiative being studied in this chapter is the Tonga Energy Road Map (TERM), a document that hopes to drive a comprehensive conversion to RE sources in order to reduce the electricity tariff within Tonga. This case study will focus on the document itself, how it is structured and what change it looks to drive from both a political and practical perspective, as well as what projects have been and are being carried out under this initiative and which organisations are funding them. Within this, a focus on how NZ and the EU, who are both development partners of the TERM, participate will again go towards answering the second part of the main research question regarding their role in Pacific RE implementation. This chapter will include analysis of both the successes and failures that have occurred under the TERM thus far and what barriers exist to the completion of its objectives going forward. This study will constitute the practical evidence of whether and how RE implementation works in the Pacific region. While PICs are not uniform enough for this initiative to stand alone as conclusive proof one way or another on RE effectiveness in dealing with energy issues and advancing development in the region, it does act as an interesting test case which may have use as a model for future implementation.

These three different analyses should contribute to a better understating of RE use in the Pacific context and the role that exists for NZ and the EU in this regard. Academic work will act as evidence for whether a theoretical basis for RE use in the developing world exists, as well as illustrating what mechanisms exist and how effective these have been thus far. Policy documents will define the depth and strength of NZ-Pacific and EU-Pacific relations, particularly in regards to RE issues and development. The TERM case study will show how these dynamics work in practice under the largest RE initiative undertaken in the Pacific region thus far.

Renewable Energy in the Developing World

The broader context for this research is the use of RE in the developing world. There are a number of factors to consider when looking at the potential of RE implementation in developing countries.

First, the fact that energy infrastructure is usually limited in developing countries means targeted implementation of RE systems could quickly have an impact on the energy market. While the introduction of renewable sources of energy would not be designed to replace current sources in the short-term, there is the ability in some developing countries, due to low levels of energy consumption, for RE sources to eventually become the primary source of power, supplemented by fossil fuel (FF) sources. In the long-term, a system by which RE sources are able to service base load requirements most of the time would mean FF sources would only need to be used sparingly, during times when intermittent RE sources were not able to produce power. In this way, utilising renewable sources of energy could serve a dual purpose of increasing the volume of power in developing countries energy markets and helping alleviate reliance on FF based sources of energy.

Second, developing countries tend to have conditions that are suited to the use of RE installations. Much of the developing world is situated in areas which have a warmer climate and long sunlight hours, conditions suited to the use of solar power generation. The island nations of the Caribbean and Pacific regions lend themselves to wind generation due to heavy and consistent off-shore wind flows and on-shore trade winds. In the future they will make a good proving ground for ocean energy generation, with tidal flows between atolls and in shallow areas of coastline being ideal for this type of production. This abundance of natural resources means that SIDS may be more suited to RE implementation than other parts of the developing world as it could potentially harness theses sources more efficiently.

Third, the distribution of populations in developing countries is usually more focussed in rural areas than in the developed world. Particularly in island nations, issues with power supply to remote islands or populations are of critical importance. The ability for RE sources to cater to these isolated populations by supplying smaller amounts of power locally, through solar photovoltaic (PV) panels or small wind turbines, is a key factor in why a shift towards these sources could be more effective in the developing world than elsewhere. While RE technology is not at the point of being able to service large urban populaces' energy requirements, the potential to convert the numerous smaller rural or island areas to alternative sources is an important consideration when considering the benefits of implementation in this context.

Finally, the fact that alternative sources can compete on a cost basis is perhaps the most important factor when considering whether these sources could benefit the developing world. For the most part, the developed societies of the world produce relatively low-cost power from FF sources such as coal, oil, gas and uranium. However, the developing world has numerous barriers to accessing this type of low-cost power. In most cases, the infrastructure necessary to extract these minerals for processing is not possessed by the governments or companies of developing nations. This results in an underutilisation of natural resource wealth, something that is good for the conservation of their natural environment but bad for the distribution and affordability of electricity. Alternately, the mineral wealth of developing nations is sometimes mined by foreign companies who can draw large profits by paying for the right to mine certain mineral rich areas. In this case the conversion of that mineral wealth into electricity usually occurs in the developed world, where demand is higher. This problem is exacerbated in island nations where the transportation of FF adds to the cost of production significantly. The cost rises even further for isolated islands which have to transport the fuel source from the main hub island to their local power generation units. This results in power not only being difficult to access but also particularly expensive. Implementation of RE in all of these instances could theoretically bring down the long-term price of electricity without having a

negative effect on either the natural landscape of the country in question or the atmosphere. For more isolated communities, the change in power costs could be even more pronounced, by reducing or eliminating the cost of FF transportation.

The implementation of RE in the developing world goes to the heart of a number of power supply and cost related issues which are barriers to development. Increasing access to electricity in remote populations will allow greater use of information and communication technologies, an important step towards becoming a more modernised society. Gradually replacing inefficient and high cost FF systems of production with localised RE sources will satisfy the dual goals of lowering power costs and helping these nations develop sustainably.

While there are a number of reasons for this transition to occur, there are also factors that stand in the way of it happening. For RE implementation to become an effective and long-term part of energy supply in the developing world, education of the population on the strengths and drawbacks of making this transition would be a base requirement. Eventually, maintenance and operation of RE capacity would need to occur locally, following a transitional period. Finding out how significant these two considerations are with regards to RE implementation in the Pacific will be important to answering the questions of this research. In addition, funding for the installation of these renewable production facilities, operation over the short to mid-term and education for the long-term would all have to come from external agencies through development aid funding. This requires a significant commitment in financial terms from the developed world and the patience to see the transition through, something which has not always been guaranteed on projects in other sectors. Conceptually, RE implementation in the developing world appears to have merit but nevertheless, practical, bureaucratic and financial barriers remain.

Why the Pacific?

For the Pacific, the high price of electricity is a potential barrier to development. Low levels of electricity consumption and high tariffs mean that RE use in the Pacific context would potentially have more social than environmental benefit. These high prices are due to a system in which power is derived from diesel generators in most PICs.[1] While implementation of RE in developed nations is still somewhat cost-prohibitive, in the Pacific using these new sources to replace or supplement current supply could result in a significant savings. In Tonga for example, meeting their current RE implementation targets could reduce the electricity tariff by over 25%.[2] Reducing the cost of electricity could have wide ranging effects on schools, hospitals and homes in the Pacific, particularly on the remote islands which suffer from especially high prices at present.

Electrification

The energy issues for the Pacific go beyond just cost for those with ready access to electricity – a 2009 study showed that 70% of Pacific Islanders remain without any access to electricity.[3] With the large number of isolated rural and island communities in the Pacific region, grid based access simply isn't practical or cost-effective in many areas. RE sources are currently more developed in a small-scale context, making them a possible solution to the electrification problem as well as heating and cooling issues.

[1] "Joint IRENA-PPA Workshop: Assessment of Grid Stability for Increased Renewable Energy Integration in the Pacific Region," (Vanuatu: IRENA, 2012), 1.

[2] "The Official Dedication of Maama Mai Solar Farm Facility by His Majesty King Tupou VI.," Tonga Power Limited, http://www.tongapower.to/NewsRoom/MaamaMaiSolarFarm.aspx.

[3] Tom Roper, "Climate Change - A Challenge for Pacific Nations and their Utilities," in *Pacific Power Association 18th Conference* (American Samoa2009), 11.

The ability for RE sources to reduce costs for those with access to electricity in the Pacific region is of primary importance to this research, due to its effect on the viability of implementation and its potential impact on development. However, the potential for RE technologies to be an effective, localised way of bringing electricity to those Pacific Island communities currently in need of supply is of equal importance from a development point of view, as it likely has an impact on the broader question of whether RE sources can be an effective mechanism for stimulating development. Many of those within the Pacific region who are not connected to a grid are only able to heat and cool their houses and schools and run appliances through the use of on-site generators or more basic traditional means.

While the case study will be focussed on Tonga, a country where electrification is not a primary concern, the literature review will include work on the topic of electrification with emphasis on links to RE implementation wherever possible.

Natural Resources for Renewable Energy

The Pacific region's climate has many of the conditions considered suitable for the implementation of RE sources. Understanding which RE sources would best service the needs of the Pacific, both by being efficient and cost-effective and also by minimising the impact on the region's thriving tourism industry, is an important consideration when looking at implementation plans. To this is end, both measures of energy production efficacy of RE as well areas within the Pacific best suited for implementation need to be considered. Aesthetic concerns are another significant barrier to large scale implementation in the Pacific, so installations with less visual impact or with less need to be place in high exposure locations should be prioritised. However, these aesthetic impacts would need to be balanced against the benefits they would provide in energy cost and environmentally.

The trade winds found in the countries of the Pacific region are both strong and consistent, making them a good candidate for wind generation. PICs may also

potentially be able to utilise the higher output wind turbines that require these conditions. Another option in the future would be offshore wind farms, taking advantage of the large exclusive economic zones relative to land mass found in the Pacific region. Finding locations for offshore turbine implementation could be difficult due to the need to minimise impact on the tourism and fishing industries the countries of the Pacific rely on so heavily, but if as suitable locations exist this could be a viable option.

Solar generation is a viable option in PICs due to their warm climate and long sunlight hours. The use of solar PV power production is the most common in current implementation projects in the Pacific. Solar panels are being used in small scale housing and school projects and are effective due to the generally clear skies and hot weather found in the region. Long sunlight hours are the key for effective energy production from solar panels, as the process involves creating power from sunlight, rather than harnessing its heat as with solar thermal sources. Solar thermal installations could also be effective in harnessing the warm Pacific climate, either through solar thermal troughs or towers. With Spain and Portugal being pioneers in solar thermal technologies, there could be a role in this type of implementation for the EU. Again, the benefit of these technologies would need to be balanced against their visual effect on the natural environment, as the pristine scenery found in the region helps drive tourism.

Many countries in the Pacific region would be well placed to take advantage of ocean energy generation once the technology matures. Strong tidal flows between small islands and in coastal inlets would provide the type of power required for these sources. Wave generation would also be appropriate for many PICs due to their abundant coastlines. At present ocean energy generation is still in its early stages and isn't as efficient as wind or solar sources, but if the technology catches up, Pacific countries could be in position to benefit.

European Union Incentive

There are a number of reasons for the EU to be involved in a potential transition to RE in the Pacific region. The EU has been involved in the Pacific through its economic partnerships and collective agreements for decades and takes an active role in encouraging development in the region. Helping facilitate a transition to RE sources in the Pacific region could serve a variety of purposes for the EU.

As a leading provider of financial aid, the EU could be a primary funding agency for the installation of RE infrastructure in the Pacific. A region wide implementation project would take place over a long period of time and would have tangible results which could make it an attractive proposition for the EU as a way of projecting its power globally. Projects undertaken in this sphere throughout the Pacific region could also fall under the 7th Millennium Development Goal (MDG), focussed on ensuring environmental sustainability,[4] and help give credence to the EU's presence within that scheme. The EU has committed substantial funds to the achievement of the MDGs and a flagship RE programme in the Pacific could help give the EU a more visible profile as an aid provider and thus help gain it more legitimacy in the international system. The EU also sees itself as a world leader on climate change. Being a primary player in converting the Pacific region from being dependent on FF sources to having a large percentage of their energy supplied by renewables would be a big step in legitimising this claim. The EU has a number of climate change related goals for its member states but an external project of this magnitude would offer greater benefits for the organisation's international profile and standing.

The member states of the EU contain some of the world's biggest producers of RE technologies. Undertaking a large scale project across the Pacific region could provide these manufacturers with an opportunity to both raise their production levels as well as their profile. Particularly in regards to wind power, German and Danish

[4] "Goal 7: Ensure Environmental Sustainability," (New York: UN Department of Public Information, 2010).

companies could benefit greatly in any offshore wind farm sites in the Pacific as well as from producing smaller installations for isolated islands. Facilitating economic growth within the EU, while confined to a small sector of the economy, could be another consideration when looking at RE implementation in the Pacific and has the potential to provide good publicity for the EU within its borders.

Enshrining any EU led RE scheme in the new Pacific Economic Partnership Agreements (EPA) could be an effective strategy for both sides. As conditions for financial aid have been based on democratic, rule of law and human rights based goals before, the EU could protect itself by requiring continued use of RE sources as a precursor for aid. From the Pacific perspective, conditions requiring EU investment to establish RE infrastructure would ensure long-term and meaningful involvement from the EU. Climate change has long been a part of the agenda between the two sides but focussing this directly on RE could provide value for both groups and inclusion of binding RE goals in the new Pacific EPAs could be the simplest way to achieve this. Whether this is feasible will be considered in the policy framework section of this thesis, as pace of progress on the Pacific EPAs will obviously be a key factor.

New Zealand Incentive

NZ should share some of the EU's reasons for wanting to play a role in any RE implementation project in the Pacific region. Geographical proximity as well as NZ's high Pacific population and role as a leader in the region make it a logical player in helping any transition to RE sources. NZ, like the EU, places an emphasis on being a leader in climate change related issues. While this focus has lapsed somewhat in recent years, an opportunity to be a primary player in a climate change project of this magnitude within the Pacific region could help re-establish NZ as a leader in this regard.

There are a number of Pacific migrants in NZ and undertaking a project which would make life in PICs more affordable could have political benefit for the government in both a national and international context. Long-term, reducing the cost of living in the Pacific islands and creating additional jobs in the region may help reduce migrant numbers or even create a stream of return migration. In addition, a significant amount of the money earned by Pacific migrants is returned to their home countries in the form of remittances, to help family cover the cost of living. Mitigating the need for this flow of money out of the country could have small positive effect on the economy here, allowing money to be spent within NZ rather than going overseas. As a country with a large Pacific population, heritage and responsibility, being part of an RE project in the Pacific region has a number of potential benefits for NZ.

NZ contributes a relatively small amount of development aid when compared to larger bodies like the EU, so it may seem unlikely that NZ would be able to be the primary funding agency in a meaningful transition from diesel generation to RE sources across the Pacific region. However, NZ focusses over 50% of its development aid on the Pacific region,[5] which means its role in funding RE projects could be less negligible than its gross external development budget would indicate. Nevertheless, contributing manpower and technical expertise might be the most logical role for NZ in Pacific RE implementation projects. Due to the ease of access to the Pacific from NZ, utilising expertise from NZ to help build and maintain new RE installations for a time afterwards would make sense. In addition, NZ personnel could be useful in the long-term by educating the populations of Pacific nations about the new sources of energy being used and supporting the locals tasked with running the installations. This could occur either by personnel staying in the islands as consultants or providing remote assistance from NZ, with the ability to quickly travel to the source of a problem when required. In this support role, NZ has tangible advantages over other potential contributors and could establish a deeper presence in the region for decades to come.

[5] "Partnerships Fund Criteria," New Zealand Government, http://www.aid.govt.nz/funding-and-contracts/nz-partnerships-international-development-fund/partnerships-fund-criteria.

Finding out whether the implementation of RE in the Pacific has the potential to contribute to development in the region is the purpose of this research. This will be analysed from both a theoretical and practical perspective within the different sections of this thesis. Understanding how NZ and the EU could participate in this type of transition to RE sources is a secondary objective. With the already established relations both NZ and the EU have with the nations of the Pacific, they could be important actors in facilitating RE projects in the Pacific as both have looked to take a leading role in the development of the region in the past.

Chapter Two: Literature Review

This literature review is designed to capture the range of theoretical and practical work undertaken on the topic of RE in the developing world. It will be split into two basic sections, the first containing sources focussed on the theory surrounding energy and development along with any evidence of results this relationship has yielded thus far, the second looking at RE in the developing world. Each section relates to subject matter that will help satisfy the goals of this research. The first will provide sources key to understanding whether there is a significant relationship between the provision of energy and socio-economic development. The second section will be more extensive, as it goes to the heart of this research; looking at what issues there are at a basic energy supply level while also providing information on what form RE implementation projects in the developing world might take and the main challenges preventing these from going ahead.

Sources that focus on energy as a development mechanism in a more general sense are of great relevance to this research. The goal in using these sources is to understand where energy fits into the development framework and how relevant and impactful RE implementation could be for a region like the Pacific as a socio-economic development mechanism. When looking at the theory of energy and development I will utilise recent sources as well as older work, as they retain their relevance in this context longer than works of a more practical nature would.

Finally, looking at RE in the context of the developing world is important in order to understand potential applications in the Pacific region. One focus of this section will be the tools available for implementation of RE sources in the developing world, particularly the CDM. Any work done on RE use in the developing world generally could provide relevant areas for discussion but isolated rural areas have many issues which parallel those found in the Pacific region, so considering sources focussed on these areas in particular is potentially beneficial. Beyond this, studies on SIDS are obviously the most relevant to the Pacific context outside of research done on the region itself, so will be emphasised.

Energy and Development

In the opening chapter of *International Development Policy: Energy and Development*, Carbonnier and Grinevald examine the connection between energy and development. They discuss how to leverage FF resources into tangible development rather than just increased wealth and the role institutional stability plays in this.[6] The difficulties in pursuing development using natural FF assets is highlighted, with Carbonnier and Grinevald concluding that the solution to this is for those developed and developing countries involved to share financial and technological responsibilities logically in order to create a beneficial cooperative relationship.[7] The need to provide electricity to the estimated 1.4b people without access currently is noted,[8] with a strong policy framework incentivising RE initiatives seen as being vital to this goal.[9] Carbonnier and Grinvald close by advocating for scientific perspectives to be considered and incorporated in policy with regards to energy and climate change, so that control of existing energy resources and development of RE technology can occur in a more cooperative fashion in the future.[10] This text gives a broad overview of the relationship between energy and development, taking into account the current dominant role of FF sources globally as well as the role RE has to play in the coming decades, particularly with regards to the developing world. With regards to this research, the emphasis placed on strong institutional and policy frameworks is notable, as the value of providing energy supply from localised installations was not questioned, only the conditions necessary for these sources to be implemented.

[6] Gilles Carbonnier and Jacques Grinevald, "Energy and Development," in *International Development Policy: Energy and Development*, ed. Giles Carbonnier (Hampshire: Palgrave McMillan, 2011), 13-14.

[7] Ibid, 18.

[8] Ibid.

[9] Ibid.

[10] Ibid.

In their section of Rosemarie Philips' book, *Energy as an Instrument for Socio-Economic Development*, Goldemberg and Johansson consider energy as a means to facilitate access to basic human needs in the developing world, a point originally broached in their report *Energy for a Sustainable World*, written eight years earlier with Reddy and Williams.[11] This section summarises and introduces a number of papers on the topic of energy and development and notes that "energy use, as practiced today, is indeed a serious obstacle to development and to the improvement of living standards. It is also clear that improved energy end-use efficiency and increased use of renewable sources of energy would go a long way in solving the energy problems of developing countries."[12] They discuss the ability of developing countries to 'leapfrog' developed countries by utilising the most recently developed and thus most cost-efficient RE technologies.[13] The basic assertion that RE could help ease energy issues in the developing is interesting in the context of this research, as it pertains to the ability for these sources to have a positive impact on development.

In another section of *Energy as an Instrument for Socio-Economic Development*, Suarez considers energy consumption as a tool to improve quality of life and promote sustainable development from the individual level up rather than the top down.[14] He looks at the relationship between energy and the Human Development Index (HDI), with the results showing "that energy has a determinant influence on the HDI, particularly in the early stages of development."[15] Suarez makes an important distinction between energy requirements and energy demand in the context of the developing world, making note of the large amount of non-traditional, off-grid energy consumption in areas where access is limited either by geographic or

[11] José Goldemberg et al., "Energy for a Sustainable World," (World Resources Institute, 1987), 43-44.

[12] José Goldemberg and Thomas B. Johansson, "Overview," in *Energy as an Instrument for Socio-Economic Development*, ed. Rosemarie Philips (United Nations Development Programme, 1995), 7.

[13] Ibid.

[14] Carlos E. Suarez, "Energy Needs for Sustainable Human Development," in *Energy as an Instrument for Socio-Economic Development*, ed. Rosemarie Philips (United Nations Development Programme, 1995), 9.

[15] Ibid, 9-10.

financial constraints.[16] In closing, he makes mention of barriers that need to be overcome in order for energy supply to become a tool for development in the areas of the world most in need. These include: the need to balance provision of energy to the developing world with limiting energy consumption globally, lack of resources from an economic and expertise point of view, and the need to balance energy needs in the present with the potential environmental impact of satisfying these.[17] Technological advancements in the RE field since the time of writing may mean that the necessary supply of energy can now be attained without contributing to unsustainable energy use globally.

Following on from this in *Energy as an Instrument for Socio-Economic Development*, Batliwala considers energy use in the developing world from a quality and efficiency standpoint, rather than purely based on quantity of consumption and supply. The high price the developing world pays for inefficient, unreliable energy is one clear barrier to improved living standards according to Batiwala.[18] Given the high concentration of the world's poor in rural areas and the reliance on agriculture in many of these developing countries, consistent provision of efficient and lower cost energy could have a significant economic effect.[19] In a social context, there are basic human needs that are reliant on energy, such as being able to deliver clean water and provide adequate healthcare,[20] and as a result improving the quality and efficiency of energy supply could bring with it associated societal benefits for the isolated rural communities of the developing world. Batiwala concludes that "Nations must invest in improved energy systems to achieve social justice as well as economic growth",[21] a reality which holds true for much of the Pacific region. Whether FF or

[16] Ibid, 13-14.

[17] Ibid, 16.

[18] Srilath Batliwala, "Energy as an Obstacle to Improved Living Standards " in *Energy as an Instrument for Socio-Economic Development*, ed. Rosemarie Philips (United Nations Development Programme, 1995), 19.

[19] Ibid, 21.

[20] Ibid, 23.

[21] Ibid.

RE sources would be better suited to satisfying the conditions outlined is not addressed by Batiwala in this paper, rather he advocates for improving EE by any means.

McMichael considers energy and development through a different lens in his book *Development and Social Change: A Global Perspective*. In it, he specifically discusses the fact that energy is an element missing from the MDGs.[22] The provision of energy is tangibly related to the education, poverty and environmental sustainability pillars of the MDGs and may work more effective within this framework as a facilitator of the goals rather than being something that should be explicitly included itself. However, the fact that it avoids more than a cursory mention even within the more detailed breakdown of these three targets and how to achieve them[23][24][25] indicates that energy may not be seen as having a primary role in the eradication of these key issues in the developing world. This could have an adverse effect on the emphasis on energy in developing states' policy. McMichael discusses the huge potential solar thermal energy sources could have in aiding development, due to the suitability of the climate in much of the developing world, but this is conditioned with a need for costs to drop further.[26] Nevertheless, the salient take away point for this research is the lack of provisions for promoting efficient energy use, let alone RE sources, within the MDGs. As an initiative with wide ranging and ambitious goals, the omission of energy considerations could illustrate a more general lack of emphasis within the development nexus.

[22] Philip McMichael, *Development and Social Change: A Global Perspective* (Los Angeles: SAGE, 2012). 276.

[23] "Goal 7: Ensure Environmental Sustainability."

[24] "Goal 1: Eradicate Extreme Poverty and Hunger," (New York: UN Department of Public Information, 2010).

[25] "Goal 2: Achieve Universal Primary Education," (New York: UN Department of Public Information, 2010).

[26] *Development and Social Change: A Global Perspective*: 278.

Jansen explored the connection between energy and the MDGs further in his article *Energy for Sustainable Development*, specifically mentioning that energy is well suited to help achieve the environmental sustainability and poverty eradication goals.[27] He goes on to argue that sustainable energy is a crucial element of sustainable development and that "The challenge to achieve a continuous justified level of welfare for the growing world population of future generations requires radical renewal of systems of production and consumption and of governance."[28] He advocates a new system in which communities of the developing world are not merely spectators to a RE transition but are actively involved in the resolution of their energy issues.[29] By providing education and training the communities can spearhead their own development by being responsible for the maintenance of any installed RE production and by being able to assist with any future implementation in the area. In this way these populations will see a sustained impact from RE technologies being introduced, which can help them achieve growth in a number of MDG areas.

The scope of the energy poverty problem is outlined in *Environment, Energy, and Society: A New Synthesis*. In the section most concerned with energy and development, Humphrey, Lewis and Buttel primarily focus on oil dependence in the developed world but also highlight how important it is for the International Energy Agency and World Energy Commission to overcome "energy poverty throughout the world without creating ecologically damaging emissions".[30] Given that energy use and demand in the developing world is increasing,[31] meeting demand with RE sources where possible could provide a way to avoid the same emissions increases the developed world experienced during its rise. However, with the issues many

[27] Ir Jansen, "Energy for Sustainable Development," *Global Watch* 2, no. 1 (2007): 29.

[28] Ibid.

[29] Ibid, 42.

[30] Craig R. Humphrey, Tammy L. Lewis, and Frederick H. Buttel, *Environment, Energy, and Society: A New Synthesis*, 1st ed. (Belmont: Wadsworth Thomson Learning, 2002). 141.

[31] Ibid, 139.

developed states are having with their own energy security, efficiency and sustainability, including the United States and many EU member states, it is questionable whether organisations such as the International Energy Agency and World Energy Commission will have their focus on the ever present but growing issue of energy provision in the developing world.

Renewable Energy in the Developing World

Moore discusses the role RE can play in economic development in his article *Renewable Technologies to Power and Empower the Developing World*. He recommends moving away from the centralised energy production method used during the development of currently industrialised nations and instead looking to distributed RE sources for the developing world.[32] By utilising natural resources for wind, solar, hydro and biomass in unison with existing FF generation, distributed production through hybrid power systems would be possible.[33] Moore argues that this type of model would have significant value in the developing world and may eventually be able to be exported back to developed nations.[34] He further states that "By using a base of indigenous or local resources, development activity can take place without waiting for the extension of the central grid or its attendant capital costs",[35] allowing for faster and more cost-effective provision of energy. This more rapid, stage by stage implementation would encourage foreign investment, with results and returns likely to be more immediately available.[36]

[32] Michal Moore, "Renewable Technologies to Power and Empower the Developing World," *Colorado Journal of International Environmental Law and Policy* 16, no. 2 (2005): 391-92.

[33] Ibid, 393.

[34] Ibid.

[35] Ibid, 394.

[36] Ibid, 396-397.

This article attempts to address two or the core problems with RE projects in the developing world; the high initial costs associated with implementation and the lack of security of supply inherent with technologies reliant on intermittent sources of energy such as the wind or sun. The move away from a centralised model of energy production is particularly relevant when looking at applying RE sources in isolated rural or island areas, where grid extension is often unfeasible. Suggesting a distributed method of production using a hybrid of fossil sources and renewables is not unique to this article, but the idea of stage by stage implementation that would reduce initial costs while allowing results to be obtained and adjustments made in a shorter timeframe is intriguing and worthy of further consideration.

In their book *Renewable Energy: The Facts*, Seifried and Witzel provide a basic introduction to RE implementation and use in the developing world. They discuss the social, financial and policy obstacles to RE projects taking place in developing countries, noting that issues such as the poverty are of far greater importance than the environmental merits of RE implementation in these areas.[37] The value RE sources, particularly home based solar systems, can have as a poverty alleviation tool in parts of the developing world not connected to any national grid is mentioned, but the need for larger scale on-grid applications to come beforehand is also emphasized.[38] This is explained in two ways; from an economic perspective it is necessary for technology to be developed by industrialised countries until they are cost-effective for the developing world and for the perception of RE it is important that they aren't considered a "technology for the poor."[39] Whether large scale grid based projects are the best way to overcome the expense of RE technology is debatable, as there are a lot of up-front costs involved in the initial installation stage, although this doesn't necessarily have to fall solely on the country or region in

[37] Dieter Seifried and Walter Witzel, *Renewable Energy: The Facts* (2010). 204.

[38] Ibid.

[39] Ibid.

question.

The perception of RE is important to the future of energy production globally, a point Seifried and Witzel are especially concerned with in their book, but it is equally possible to consider small scale implementation in off-grid projects as an opportunity to experiment with certain technologies before attempting to utilise them on a grander scale. The rest of this section will look in more detail at RE in the context of isolated rural and island areas and tools to aid implementation but this text gives a good overview of the broader issues facing the application of RE technologies in the developing world.

Mechanisms for Implementation

Lloyd and Subbarao analyse RE and development in the context of the CDM. They discuss the threat posed by rising oil prices to the developing world, which contains many countries reliant on importing FF for energy production, and how RE sources could provide a way to mitigate this problem.[40] Issues related to the high and rising use of finite FF resources such as oil, coal, gas and uranium as well as the increasing global population, particularly in the developing world, are raised as further reasons why alternate sources need to be considered.[41] Traditional sources of energy are projected to be unable to satisfy the coming demand as peak oil and gas production grow nearer[42] while reliance on coal from large and still growing economies in China and India makes the future of that resource less dependable.[43] As FF sources will potentially be unable to maintain the current status quo, relying on them to foster

[40] Bob Lloyd and Srikanth Subbarao, "Development Challenges Under the Clean Development Mechanism (CDM)—Can Renewable Energy Initiatives be put in Place Before Peak Oil?," *Energy Policy* 37, no. 1 (2009): 237.

[41] Ibid, 238.

[42] Ibid, 238.

[43] Ibid.

development through energy provision in the developing world seems inadvisable. While current energy consumption from the developing world is lower than from developed countries currently, this is not predicted to remain the case,[44] making the implementation of RE production now a potentially impactful decision in the future. While it is impractical to look at converting global energy production from FF sources to RE ones wholesale for a number of reasons,[45] the current low demand in the countries of the developing world makes a widespread conversion to RE supply worth exploring.

In looking at the CDM as a tool for fostering sustainable development in the developing world, Lloyd and Subbarao discuss some issues preventing it having the impact desired in the areas most in need. The most basic among these is that the two goals of the CDM, to help create clean development for host developing countries while also contributing to the emissions reductions required under the Kyoto Protocol for the country running the project, have not worked in concert as envisaged.[46] For countries using CDM projects to reduce the need for domestic emissions reduction, the emphasis is on gaining the most Certified Emissions Reductions (CER) possible, which leads to initiatives in large developing countries being favoured over smaller scale ones in some of the Least Developed Countries (LDC),[47] such as the members of the African, Caribbean and Pacific Group of States (ACP). They go on to discuss the role RE sources could play in alleviating poverty in the small, isolated areas of the developing world and the need for it not to be used as a top down solution but rather one taking into account the needs of the community involved.[48] Due to this and the prohibitive initial costs of substantial RE installations, utilising small scale community based projects and then looking to

[44] Ibid, 239.

[45] Ibid, 239.

[46] Ibid, 240.

[47] Ibid.

[48] Ibid, 241.

expand them over time is considered a potential best practice[49] as it fosters community involvement and ownership as well as satisfying development goals. With local people invested in the outcome of the project, the chances it will be adopted and accepted the community increase significantly. As a result, Lloyd and Subbarao suggest that "the future of CDMs in the next commitment period (2012–2016) be targeted and strengthened in the area of small-scale community renewable energy projects".[50] This would help give these populations access to a sufficient supply of energy and the opportunities for growth and poverty reduction that come with that, while also helping the communities' country meet their development goals.[51] Throughout this article, Lloyd and Subbarao are clear on the role RE can play in aiding development but the particular focus on isolated communities is of particular relevance when regarding what impact these sources could have in the Pacific context. The prevalence of CDM projects in the Pacific could help answer the questions posed in this research, both in terms of whether RE is a practical solution to electrification and energy supply issues in the region and regarding which actors would be best suited to assist in implementation if it is.

Schneider, Schmidt and Hoffmann are interested in the impact of certain variables on RE implementation in their article, *Performance of Renewable Energy Technologies under the CDM*. They look at global carbon price as one variable that could influence uptake of RE technologies but most relevant to this research is the examination of regional variables and their potential impact.[52] Of particular interest is how electricity cost affects RE implementation under the CDM. Their findings show that the electricity tariff variable can have a significant effect on the profitability of RE technologies and that either supporting production through a feed-in tariff or discontinuing subsidies to FF producers can help mitigate the high setup costs of RE

[49] Ibid, 243.

[50] Ibid.

[51] Ibid, 244.

[52] Malte Schneider, Tobias S. Schmidt, and Volker H. Hoffmann, "Performance of Renewable Energy Technologies Under the CDM," *Climate Policy* 10, no. 1 (2010): 19.

installations.[53] While this theoretically decreases the savings from RE production for the end users in developing countries, the guaranteed prices from a feed-in tariff scheme could make implementation a possibility where previously it was economically unfeasible for investors. Maintaining profitability for those responsible for RE projects under the CDM is the best way to ensure the secure provision of electricity to the areas of the developing world in need while still maintaining the ability to reduce end user costs. Schneider, Schmidt and Hoffmann suggest reducing transaction costs under the CDM,[54] noting that this is particularly important for RE projects as they currently make solar PV projects impractically expensive and affect the viability of wind and hydro implementation.[55] Considering the direct contribution RE projects can make, fostering sustainable development in host countries, reducing extraneous costs and allowing more widespread application of RE technologies in the developing world would go a long way towards satisfying the goals of the CDM.

Flamos' article, *The Clean Development Mechanism—Catalyst for Wide Spread Deployment of Renewable Energy Technologies? Or Misnomer?*, analyses energy in the developing world through the CDM, taking into account where it might be most effectively applied and which RE technologies could be most impactful in host countries. He discusses the potential alignment of climate change mitigation with other issues such as poverty and energy security, stating that "poverty in developing countries could be alleviated by offering to rural communities reliable, affordable and sustainable (with a view to local aspects) energy technologies...As these technologies often also reduce or avoid greenhouse gas (GHG) emissions, such projects would also address the climate change issue."[56] Flamos highlights the discrepancy between the high percentage of RE projects carried out under the CDM

[53] Ibid, 32.

[54] Ibid.

[55] Ibid, 30-31.

[56] Flamos, Alexandros. "The Clean Development Mechanism—Catalyst for Wide Spread Deployment of Renewable Energy Technologies? Or Misnomer?" Environment, Development and Sustainability 12, no. 1 (2010): 89-102, 90.

and the proportionally lower amount of CER credits projected to be issued for these compared to other emissions reduction schemes.[57] While these other project types contribute to greater immediate emissions reductions,[58] they don't play any long-term role in the sustainable development of the host country. This means initiatives involved in the direct reduction of GHGs provide greater benefit to the industrialised nations involved in the form of CERs than to the host countries trying to meet developmental goals. Flamos looks at a group of RE technologies that were analysed in the ENTTRANS study from both a developed and developing world point of view, in order to help understand the issues and opportunities there are for projects of this nature under the CDM. He concludes that the CDM favours large scale projects,[59] making implementation of RE sources on a smaller scale, such as in the small island nations of the Pacific, less profitable from a CER perspective. Flamos raises additional barriers to implementing RE technologies in the developing world, stating that, "In general it can be noted that the market conditions in the developing world hampers, in many cases, the widespread deployment of RES technologies, due to a number of non technical barriers".[60] As one of the most economically competitive RE sources, wind energy projects, particularly large scale ones, are popular under the CDM and Flamos makes mention that they are particularly suited to isolated areas and island states.[61] Solar is less financially viable overall but is also suited to island states where transportation and grid extension for FF sources is prohibitively expensive.[62] The article closes by highlighting the need for increased awareness and education on RE sources in CDM project host countries, so when new technologies

[57] Ibid, 91.

[58] Ibid.

[59] Ibid, 98.

[60] Ibid.

[61] Ibid, 99.

[62] Ibid.

are implemented, the potential economic benefits can be fully realised.[63]

While this article highlights the opportunities for implementation of RE sources, including those particularly suited to isolated rural and island communities, it also shows why the CDM might not be a tool suited to facilitating the type of small scale, localised projects that would be required in the Pacific region. From an egalitarian perspective, the CDM provides a potential dual benefit by providing CERs to developed nations who help host countries on the path to sustainable development. The reality however is that the greatest percentage of CERs are provided to projects which result in a direct and immediate reduction in GHG emissions or large scale RE initiatives suited to the bigger countries of the developing world. Flamos underscores the suitability of RE sources such as wind and solar to the Pacific region but also illustrates why industrialised nations are less likely to favour implementation in this context, purely based on potential cost versus likely benefit.

Sovacool evaluates the effectiveness of pro-poor public-private partnerships (PPP) for energy provision in the developing world in his article *Expanding Renewable Energy Access with Pro-Poor Public Private Partnerships in the Developing World*. This type of PPP is designed to "provide basic services for the poor, namely access to water, energy, health services and biodiversity conservation."[64] He considers eight examples of PPPs[65] and concludes that this general model is an effective way of overcoming the challenges associated with increasing access to energy for the poor communities of the developing world.[66] A particularly relevant case to the Pacific context is the Rural Electrification Project in Laos. World Bank and Global

[63] Ibid, 101.

[64] "Pro-Poor Public-Private Partnership ", United Nations Economic and Social Commission for Asia and the Pacific, http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/PPPPP/p-pppp.asp.

[65] Benjamin K. Sovacool, "Expanding Renewable Energy Access with Pro-Poor Public Private Partnerships in the Developing World," *Energy Strategy Reviews* 1, no. 3 (2012): 181.

[66] Ibid, 191.

Environment Facility (GEF) grants funded the project, which aimed to improve and expand access to energy in rural villages across Laos with a view to reducing poverty while maintaining environmental sustainability.[67] This project ended up extending grid access to over 36,000 homes as well as installing in-home solar systems to over 9,000 households, exceeding its initial targets.[68] These off-grid solar systems were installed and maintained by private companies under the management of a French energy consultancy firm who were given the contract to oversee this phase of the project until the government could do so itself.[69] This type of responsibility sharing between private sector organisations, both domestic and foreign, and governmental bodies could be an effective model for solving the expertise deficit in many Pacific countries, while funding from international organisations (IO) can help make the high initial costs of RE projects manageable. In his conclusion, Sovacool posits that PPPs can overcome private sector reluctance to invest in off-grid energy projects in areas where demand and potential consumption, and therefore profit, is hard to gauge and the public sector's tendency to focus on cheaper access to electricity for existing, primarily urban, consumers rather than providing access for poorer rural populations.[70] PPPs "can be effective at meeting national and programmatic targets for electrification and access, sometimes ahead of schedule and below cost",[71] while involving several groups in a RE implementation project can help improve performance and community acceptance.[72] Finally, Sovacool notes the importance of having RE technology promotion be only one strand of a project and that effective PPPs can help create a more holistic approach to implementation.[73] This last point is important when looking at the Pacific region as institutional, financial and social barriers to implementation certainly exist, and paying these as much or more

[67] Ibid, 189.

[68] Ibid.

[69] Ibid.

[70] Ibid, 191.

[71] Ibid.

[72] Ibid, 192.

[73] Ibid.

attention than the environmental impetus behind a project would likely improve its chance of long-term success considerably.

In her article *A New Tailored Scheme for the Support of Renewable Energy in Developing Countries*, Magda Moner-Girona discusses a method by which RE sources might more easily be implemented in isolated areas of the developing world. The mechanism discussed is the Renewable Energy Premium Tariff and its purpose is to create an environment in which energy producers are incentivised to utilise RE sources.[74] A premium is paid for energy produced from RE sources and guaranteed for a number of years as a way to reduce the risk energy producers take in constructing and putting RE installations into operation.[75] The crucial element of this system would be that it would not be the end user who pays this premium, as in developing countries this simply isn't practical, but rather the costs would be paid through a local energy utility. Funds would likely come from a local government body as is the case currently with diesel generator based production[76] but contributions could come from any number of external organisations or governments. This would create a situation where RE production is appealing to investors due to the guaranteed returns while still being affordable for end users. By using a hybrid system which gets contributions from both RE and FF sources, security of supply can be guaranteed even while a transition to a more sustainable energy supply is occurring.[77] Eventually, this scheme would allow for reduced production costs through lowering dependence on FF sources and could provide additional benefits such as jobs for those within the local community constructing and maintaining RE installations.[78] This idea is of considerable interest in the Pacific context, where isolated populations in need of electricity could greatly benefit from the hybrid systems discussed in this article. With the lack of wealth in the end user

[74] Magda Moner-Girona, "A New Tailored Scheme for the Support of Renewable Energies in Developing Countries," *Energy Policy* 37, no. 5 (2009): 2037.

[75] Ibid, 2038.

[76] Ibid.

[77] Ibid, 2037.

[78] Ibid, 2041.

population, incentivising RE production at the governmental level could be a good mechanism to encourage implementation projects where previously risk to investors prevented them from occurring. Paying a premium price for RE sourced power might not allow for the immediate cost reduction for end users that RE based production might warrant but it does provide a potential solution to the problem of high start-up cost in RE projects, providing an avenue for both public and private investment while reducing the associated risks.

Application of Renewable Energy in Rural and Isolated Areas

Ramakumar explores the idea of utilising a wide spectrum of RE technologies in developing countries, particularly in remote rural areas. The conceptual framework for this is the use of Integrated Renewable Energy Systems, which aims to marry renewable technologies to geographic areas most able to create power efficiently from them. By taking a mixed approach, communities can create an energy supply based on the inherent natural resources provided by the area in which they live. As a part of this Ramakumar emphasises the need for 'energization' rather than electrification in isolated areas,[79] requiring a focus on direct energy supply rather than traditional solutions such as extending the grid to rural areas in order to provide theoretical availability without addressing supply issues. The need to "match needs with available resources"[80] through Integrated Renewable Energy Systems is the central pillar of this plan to provide 'energization' rather than just electrification. As well as advocating for a diversified solution to energy supply issues in the developing world, Ramakumar addresses quality of life elements of improving provision of energy in the developing world. He talks about how "improving the living environment in remote rural areas is a moral issue"[81] and mentions the history of institutional ambivalence towards development projects in rural areas due to a

[79] R. Ramakumar, "Renewable Energy Utilization Scenarios: A Case for IRES in Developing Countries," in *ISES Solar World Congress* ed. Yuwen Zhao D. Yogi Goswami (China: Tsinghua University Press, 2009), 2920.

[80] Ibid.

[81] Ibid, 2919.

fear of upsetting people they believed "happy and contented with their state of life".[82] This thread is of clear importance to the research goals of this thesis, illustrating both the reasons this could be a social issue of notable importance and a possible explanation for why it has not made it higher on the agenda in countries with significant isolated and undersupplied rural populations.

In their paper *Rural Electrification in the Developing World*, Barnes and Foley discuss the barriers to creating effective supply of energy to isolated communities at a reasonable cost. While this study was conducted in 2004, it touches on many areas pertinent to the Pacific and RE implementation. They emphasise the importance of having effective, independent institutional support and a low level of "political interference".[83] More interesting than the institutional element is how crucial Barnes and Foley consider local involvement and investment in these electrification projects to be. They state that "In Thailand and other countries with successful programs, the extent to which the staff of the implementing agencies felt they were laying the foundation for the development and advancement of their country is notable",[84] a consideration that has been noted as important to the long-term success of implementation projects is here mentioned as valuable at the early stages for those locals involved as workers. They also bring up the need for longer term local involvement, in order to make the transition smoother, help implementing agencies understand what is wanted and needed from the community's point of view and educate the populace to circumvent rejection of new technologies wholesale.[85] The cost of electricity for rural populations is also examined in this piece, with the idea that costs need to be kept artificially low being challenged as inaccurate. The high cost incurred by members of isolated rural communities attempting to utilise FF

[82] Ibid.

[83] Douglas Barnes and Gerald Foley, "Rural Electrification in the Developing World: A Summary of Lessons from Successful Programs," ed. Joint UNDP/World Bank Energy Sector Management Assistance Programme (Washington DC: World Bank, 2004), 3.

[84] Ibid.

[85] Ibid, 5.

sources of energy in lieu of readily having access to electricity mirrors the heavy reliance on and cost of diesel fuel for generation in the Pacific region. As a result, electricity prices only need to be reasonable, according to Barnes and Foley, in order for it to provide a saving over what these communities are typically paying.[86] Finally, Barnes and Foley argue that RE sources are not an alternative to grid based electrification but rather that they can work in concert, with traditional sources providing a convenient, secure supply of electricity while other sources supplement and reach areas where grid access is simply impractical.[87] This is relevant to the Pacific context, where there are both areas with access to power from a grid and ones isolated enough that they rely on smaller diesel generators at the local level. Those places with access to the grid could benefit from supplementation from RE sources as a way to mollify the high cost of electricity while those in smaller communities without grid access would experience even greater savings from implementing non FF sources. Those isolated communities could realistically look to have a significant portion of their energy needs covered from RE sources, making diesel generators the backup rather than the primary form of supply.

In her article *Renewable Energy for Rural Sustainability in Developing Countries*, Alazraque-Cherni looks at decentralised, off-grid application of RE and why the theoretical impact they can have has not yet come to fruition. She acknowledges the benefits of RE implementation in rural areas of the developing world; lower costs, enabling supply independent of grid extensions and reducing the impact on the environment from traditional biomass sources.[88] However, the focus of this article is on why these advantages have not led to greater uptake of these technologies in developing countries. She aims to better understand this by considering how well installations are maintained after implementation along with other factors such as whether locals had received training on how to respond to any difficulties and their

[86] Ibid.

[87] Ibid, 6-7.

[88] Judith Alazraque-Cherni, "Renewable Energy for Rural Sustainability in Developing Countries " *Bulletin of Science Technology & Society* 28, no. 2 (2008): 106.

general level of satisfaction.[89] The importance of having appropriate policy frameworks to support RE implementation in the developing world is proffered as a primary reason why more widespread application has not occurred, along with issues surrounding investment to cover high initial costs and long-term maintenance.[90] On the financial side, various barriers to investment exist, including the often significant subsidies provided to FF energy producers from the governments of developing countries.[91] This, coupled with the higher setup costs for RE technologies often makes investment undesirable and unprofitable. Issues around maintenance are often explained by the geographical reality of isolated rural communities. Without proper training within the local community, repairs have to be carried out by technicians travelling long distances.[92] Maintenance issues also constitute the main reason for dissatisfaction among end users in communities where RE installations were set up.[93] In closing, Alazraque-Cherni re-affirms the potential of RE technologies to alleviate energy supply issues in the isolated rural areas of the developing world while highlighting the need for strong institutional frameworks to incentivise investment and support projects in the long-term.[94] She suggests that a greater focus on gathering information from local users of RE projects could help shape future development of implementation in these areas, allowing for more effective application of the technologies.[95] This combination between promotion of RE energy production at the governmental level and feedback from end users could create a future in which these projects are not just theoretically impactful but practically so.

[89] Ibid.

[90] Ibid.

[91] Ibid, 108.

[92] Ibid, 109.

[93] Ibid, 111.

[94] Ibid, 112.

[95] Ibid, 113.

Zerriffi and Wilson focus on the potential for RE sources to solve the issue of energy supply in rural areas of the developing world through one particular organisation, the GEF. They state that "renewable energy projects should be pursued in rural areas when they benefit the local consumers directly (through lower costs or shielding from price fluctuations) and not for global environmental reasons unless the incremental costs are covered by others",[96] and that, in theory, the GEF's mandate is in line with this. Through analysing GEF projects in rural parts of the developing world, Zerriffi and Wilson hope to discover whether the reality matches the theory. As with other studies in this area, the value of distributed power generation over grid extension from a cost perspective is highlighted and problems with provision of information and training, maintenance and institutional support are mentioned as current shortcomings.[97] Zerriffi and Wilson find that the GEF's role in funding RE implementation projects is inconsistent and often times insufficient.[98] Despite this, the true value of the GEF may be in how it aids institutions related to RE and rural energy, helping create policy and support for promotion of clean energy and the alleviation of rural energy deficits.[99] While funding from the GEF is minimal compared to investments made through the CDM,[100] this niche role could help create a policy framework that backs RE implementation both at the initial stages and in a broader long-term sense. This could help ensure that the needs of rural communities are considered and met, rather than allowing projects in these areas to be no more than signposts of the good work being done by the developed world to help sustainable development elsewhere, despite making a minimal tangible difference.

Urmee, Harries and Schlapfer look at why RE use hasn't progressed more rapidly in the developing areas of the Asia-Pacific region despite it seemingly providing a

[96] Hasham Zerriffi and Elizabeth Wilson, "Leapfrogging over Development? Promoting Rural Renewables for Climate Change Mitigation," *Energy Policy* 38, no. 4 (2010): 1690.

[97] Ibid, 1690-1691.

[98] Ibid, 1697-1699.

[99] Ibid, 1699.

[100] Ibid.

realistic solution to the issue of rural electrification. They outline the highly varied level of electrification in the Asia-Pacific region, illustrating the need for electrification to occur particularly in the LDCs of the region.[101] The high cost of initial installation and the lack of electricity consumption presently found in these rural populations are highlighted as likely reasons for RE implementation not occurring on a greater scale.[102] They consider a number of factors ranging from institutional and financial support to the goals and impact of projects before specifically looking at two cases within these parameters, one in Bangladesh and one in Fiji. Both are solar PV power projects largely targeting home users, although the Bangladeshi one is on a far larger scale. Urmee et al. conclude that financing not only the installation of RE systems but also training the organisations involved so they could provide maintenance and support services allowed the Bangladesh project to be particularly successful.[103] In the case of the Fiji project, support and stocks of spare parts were not maintained which led to around 80% of systems eventually failing.[104] While both were initially considered a success due to positive survey results, the continued support in the larger Bangladeshi project led to it becoming an on-going success whereas the Fijian project fell into disrepair, leaving users disgruntled.[105] This fact led to the another conclusion; that consultation with local communities is highly important in order to foster a sense of ownership over these type of projects and to allow understanding and prevent mistrust of technologies once they are implemented. This concept of local ownership and education has been a consistent theme in the literature on RE implementation in developing regions. It also appears to be a potential barrier to implementation, as it requires more funding at a point where costs are already heaviest, during the

[101] Tania Urmee, David Harries, and August Schlapfer, "Issues related to rural electrification using renewable energy in developing countries of Asia and Pacific," *Renewable Energy for Sustainable Development in the Asia Pacific Region* 34, no. 2 (2009): 355.

[102] Ibid, 355.

[103] Ibid, 357.

[104] Ibid. 356.

[105] Ibid, 355-356.

planning and construction of the RE installations. Creating a sense of ownership and a solid local knowledge base without significantly adding to project costs would seem important to both the likelihood of a project getting off the ground and of it succeeding in the long-term.

Blanco analyses small scale implementation of RE technologies, looking at the issues and potential benefits for the developing world. The main technologies considered are solar, both PV and thermal, and wind based. Blanco uses Central America as his case study, where solar power sources are ideally suited due to the proximity to the equator and resulting heat and consistent sunlight.[106] He also looks at these options in comparison with traditional electricity provision methods such as grid extension and utilising small diesel generators, concluding that grid based where feasible can make a substantial economic impact while generators are cost-prohibitive for domestic use.[107] The possible quality of life benefits of RE sources are espoused in this paper, particularly the ability for solar PV technology to provide lighting which would "increase the hours available for work, recreation, and education."[108] In a point that is pertinent to the Pacific context, Blanco states that "In non-grid connected villages, dispersed energy systems offer a quick, economic, and reliable answer to the need for power."[109] Relying on a centralised power provider is not possible for many people in the Pacific, and this paper suggests that dispersed, small scale RE technologies could bridge this gap. However, so many years later these recommendations have not become widespread reality, indicating that the political, economic and societal barriers to implementation may have been greater than anticipated in this paper.

[106] José Ma. Blanco, "Photovoltaics, Wind, and Other Dispersed Energy Sources " in *Energy as an Instrument for Socio-Economic Development*, ed. Rosemarie Philips (United Nations Development Programme, 1995), 51.

[107] Ibid, 52.

[108] Ibid, 58

[109] Ibid.

Omer talks briefly about the need to improve energy access for the developing world in his article *Sustainable Energy Development and Environment*. He calls energy provision a "predominant issue in developing countries"[110] and notes the issues surrounding long-term efficacy in RE implementation projects[111]. Omer advocates a new method for RE implementation, with more flexible funding allowing the countries subject to these projects the ability to sustain installations themselves.[112] The suggestions offered in this article were brief and vague, but the idea of rethinking the implementation process could hold value if the current model continues to prove ineffective at surmounting the financial, political and social barriers in its path.

Renewable Energy in Small Island Developing States and the Pacific Region

Weisser's article, *On the Economics of Electricity Consumption in Small Island Developing States: A Role for Renewable Energy Technologies?*, goes right to the heart of the questions this research is attempting to answer. In it, he looks at why RE sources could be particularly effective in the context of SIDS, due to aforementioned factors that lead to FF electricity generation being more expensive in these types of countries than elsewhere. He expands on this by explaining that the financial situation of many of these island nations, in debt and already utilising a large percentage of their public investment for power provision, often leads to future plans being assessed more on an installation cost basis than an environmental or

[110] A.M. Omer, "Sustainable Energy Development and Environment," *Research Journal of Environmental and Earth Sciences* 2, no. 2 (2010): 73.

[111] Ibid, 74.

[112] Ibid.

long-term efficiency one.[113] As has been seen in other works, he lauds the RE resource potential of specific Pacific island nations, with solar, wind and biomass all considered strong possibilities right throughout the region.[114] This article is from 2004, so much of the policy it discusses is now outdated or has been replaced, but it is interesting to see the lack of progress has occurred in this sector in the near decade since, with many of the critiques voiced in this text being mirrored in the other, more recent studies analysed below. The possibility that RE sources could provide a cost advantage over diesel generation was already considered strong at this stage and additional environmental and energy security benefits were also considered as solid reasons to favour a move towards non FF based electricity generation.[115] Weisser laments that the governments of these developing island nations had not adopted RE promotion within their energy policies at the time, stating that politicians lacked understanding of RE technologies, there was a lack of institutions to employ and train people leading to a lack of qualified personnel in the sector as well as a poor framework for funding these types of projects.[116] These factors are again echoed throughout later work in the same area, begging the question of whether enshrining RE targets in energy policies has made any difference to the basic barriers to implementation, or if progress has stagnated for other reasons in the time since this article was published.

Weisser focuses on the relationship between energy and development in this article, especially the additional challenges facing small island nations. He states that "Electricity, in particular, has a vital role to play in the development process, with future economic growth being closely linked to the provision of adequate and reliable power supplies."[117] With regards to developing small island nations, he

[113] Daniel Weisser, "On the Economics of Electricity Consumption in Small Island Developing States: A Role for Renewable Energy Technologies?," *Energy Policy* 32, no. 1 (2004): 127.

[114] Ibid, 128.

[115] Ibid.

[116] Ibid, 129.

[117] Ibid, 129.

mentions that the lack of production and consumption of electricity makes it hard to find economically viable ways to provide what the populace requires.[118] With power being produced with small scale, FF based generators, there is little opportunity for costs to decrease. Using higher production capacity generators would allow costs to reduce on a per unit basis but this would require significant investment and without demand accompanying it, would be unlikely to make a tangible difference to end user rates. Security of supply is also easier to achieve utilising a greater number of smaller generators, as outages from one installation are not as impactful on the overall energy supply.[119] The cost of transporting fuel to outlying islands, particularly in the Pacific, is also raised as an important consideration when looking at a move towards RE sources.[120] This, along with the importance Weisser places on the role of IOs in analysis and implementation of RE sources in the context of SIDS are particularly salient points for this research. When considering the case of the TERM, looking into how many of the issues outlined in this article still exist eight years later and how many potential solutions recommended have been employed will be intriguing.

In his article *Setting an Example on Green Energy Use*, Roper considers the role of the small island states most vulnerable to the effects of climate change in the potential transition to a cleaner energy future. He focuses on the Alliance of Small Island States group, which includes all the members of the Pacific Islands Forum (PIF) except for Australia and NZ, and how they can promote the use of RE sources.[121] In addition he discusses "the link between climate change, sustainable energy and development"[122] while noting the barriers to RE implementation which

[118] Ibid. 131.

[119] Ibid. 132.

[120] Ibid.

[121] Tom Roper, "Small Island States – Setting an Example on Green Energy Use," *Review of European Community & International Environmental Law* 14, no. 2 (2005): 110.

[122] Ibid.

exist despite the potential cost reduction it could provide in the SIDS context.[123] The lack of political impetus and technical capacity are mentioned as central reasons why SIDS are not benefitting from more RE production currently, while Roper highlights the need for implementing agencies to provide technologies suitable to the environments in which they are being placed as well as providing training of locals so long-term maintenance doesn't become an issue.[124] A lack of financial assistance for SIDS based projects through the World Bank Carbon Fund and CDM mechanisms is a further barrier to implementation, with larger developing countries being more popular as host countries.[125] The most basic issue for RE implementation in SIDS however, is the high initial costs of RE installations. While RE technologies are a lower cost option in the long-term, traditional diesel based generation is cheap initially due to lower setup costs.[126] Roper concludes that without co-operation between international, regional, national and local actors, the familiarity of traditional FF generation will prevent RE implementation from having any substantial impact.[127] The comfort SIDS communities have with diesel based electricity generation does make RE implementation more complex. As mentioned in this article, training local contractors so they have knowledge of technologies and the ability to maintain and repair them is an important part of fostering acceptance of RE sources. Beyond this, general education of the community through schools and community consultation could help locals to better understand the benefits of these new technologies, and create the type of involvement that would help projects be sustained over the long-term.

In her article *Empowering the Developing World*, Clay considers some of the obstacles for RE projects and how they might be overcome. The technical,

[123] Ibid, 111.

[124] Ibid, 112.

[125] Ibid.

[126] Ibid, 113.

[127] Ibid, 116.

institutional, economic barriers for RE implementation are mentioned but the need for education is highlighted as a key factor for the potential success of a project.[128] Clay quotes a mechanical engineer from the National Renewable Energy Laboratory who was involved in implementation of RE technologies to a small island community in Chile, who states, "The challenge is convincing people at all levels in the community to adopt and accept the new technology, to understand how it fits and how it's used…You need everyone to work with everyone at all stages."[129] The need for actors involved in the RE implementation process to learn from their shared experience to improve techniques and technologies is critical according to Clay.[130] These improvements could help implementing agencies get in on the ground level in areas of the developing world where energy supply is minimal or non-existent, providing renewable sourced sustainable energy rather than starting those countries and communities down the path of FF generation.[131] The example Clay uses in this article, of a wind and diesel hybrid installation, is interesting when looking at the Pacific. The project was designed to be appropriate for the local environment, taking advantage of strong wind resources while also providing security of supply with the backup diesel generator, and provided electricity to an isolated population who previously had no centralised supply.[132] This type of project, despite being carried out over a decade ago, holds value as an example of the type of system that can help isolated island communities meet their basic needs. In addition, the importance of effective education of populations to be affected by RE implementation projects should not be ignored. Beyond the basic training for upkeep and repair of any installations, fostering community ownership of a project by consulting with and informing local people of the purpose and benefits of new technologies is a worthwhile investment in order to achieve positive long-term results.

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[128] Rebecca Clay, "Renewable Energy: Empowering the Developing World.," *Environmental Health Perspectives* 110, no. 1 (2002): 32.

[129] Ibid.

[130] Ibid, 33.

[131] Ibid.

[132] Ibid, 32.

Singh looks at both political and supply deficit issues in his paper on RE in the Pacific region. The reliance of Pacific island states on foreign sourced FF for the bulk of their energy supply and the resulting high cost of providing electricity to all parts of the region are noted as strong reasons for considering RE implementation.[133] The contrast between Australia, with its access to traditional FF sources in coal and gas,[134] and the Pacific's lack of indigenous resources is a clear example of why maintaining the status quo is not an option for improving energy security or cost in the region. The widespread reliance on imported FF means only the larger countries in the region are able to create any sort of energy mix, and this mix still only consisting of FF sources and hydro energy production.[135] In smaller Pacific island countries, where absolute reliance on importing fuel for energy generation would make RE implementation most impactful, other basic requirements are holding development back.

The traditional requirements Singh mentions for successful development of the RE sector: availability of natural resources, a strong policy framework with relevant institutional mechanisms, sufficient expertise and training and access to the necessary technologies,[136] are all areas this research is interested in investigating. Among these, Singh notes that effective planning and policy had helped Germany become a leader in the RE sector,[137] which suggests that a top down implementation strategy at the national level may be more effective than smaller scale, local initiatives. This makes the German example a difficult one for the Pacific region to follow, despite a similar lack of FF resources, as there is a disparity between the two

[133] Anirudh Singh, "Renewable Energy in the Pacific Island Countries: Resources, Policies and Issues," *Management of Environmental Quality: An International Journal* 23, no. 3 (2009): 254.

[134] Ibid, 255.

[135] Ibid, 256.

[136] Ibid.

[137] Ibid, 257.

in terms of available economic and political resources. Indeed, Singh states that the success of the German plan has been based on its strong research and development sector, and having the ability to provide whatever funding and expertise is necessary to allow progress to continue.[138] Most Pacific countries do not have this luxury, either from a financial or knowledge base point of view. Singh laments the lack of political interest in improving the knowledge deficit in the area of scientific research and development within the Pacific.[139] He notes that this is not simply a product of Pacific countries development level, as members states of the ACP from outside the region have managed to progress further and place more importance on scientific research and development, although he posits that this may be due to their proximity to the developed world.[140] This last point is particularly relevant to this research, as it highlights the role NZ could play as the closest developed nation to much of the Pacific region. As a country that has emphasised RE implementation over the past decade and that fulfils most of the traditional requirements listed in this paper, with access to resources, technology, a strong policy framework and a good scientific knowledge base, NZ would seem to be in a strong position to provide support to the Pacific region and help facilitate a shift from FF to RE sources.

Mohanty discusses the links between Pacific development, energy and climate change in his paper *New Renewable Energy Sources, Green Energy Development and Climate Change: Implications to Pacific Island Countries*. He notes the shift towards sustainable development using RE sources rather than solely trying to reduce consumption of FF as a means to mitigate climate change.[141] He summarises the basic benefits RE sources provide, stating that "The main advantages of RE sources are that they provide energy security, they are EE, non-polluting,

[138] Ibid, 260.

[139] Ibid, 261.

[140] Ibid.

[141] Manoranjan Mohanty, "New Renewable Energy Sources, Green Energy Development and Climate Change: Implications to Pacific Island Countries," *Management of Environmental Quality: An International Journal* 23, no. 3 (2012): 266.

inexpensive, locally available and more environmental-friendly and also have potential to reduce oil dependence and help achieving green growth."[142] The idea that there is a global shift towards this method of mitigating climate change is of critical importance to this research, as it can help determine the level of political impetus that exists towards fostering environmentally sustainable development in regions such as the Pacific.

Mohanty groups RE sources in various ways throughout this paper. First, there is the distinction between new and old RE sources, where he argues that production methods such as solar, wind, geothermal and tidal are part of the old group while new sources emerging include smaller scale hydro and solar production, biomass and bio-fuels.[143] He also discusses the separation of RE sources into three generations. These generations were defined by the International Energy Agency, with the first generation labelled as mass market, second as early market and third as under development. Mass market technologies are those which can already compete with traditional sources on a cost basis for their intended purpose.[144] Early market sources are those that cannot compete in the market without some level of institutional support [145] while under development sources still need significant funding and development before they can hope to compete with conventional sources of energy.[146] RE technologies relevant to this research are found in each generation, with solar heating, biomass and geothermal considered first generation,[147] solar thermal technologies categorised as second generation [148] and

[142] Ibid, 267.

[143] Ibid.

[144] "Renewables for Heating and Cooling: Untapped Potential," (Paris: International Energy Agency, 2007), 36.

[145] Ibid, 37.

[146] Ibid, 38.

[147] Ibid, 36-37.

[148] Ibid, 38.

concentrating solar power included in the third generation.[149] These groupings are a useful frame of reference when considering which RE technologies would be more likely to work in the Pacific region, particularly when looking at smaller scale electricity generation and heating projects.

Mohanty's article also looks in depth at RE implementation in the Pacific region, specifically touching on the lack of indigenous FF sources and the high cost that importing the necessary fuels places on both PICs and their citizens. He highlights Fiji as a Pacific nation with "vast potential RE resources including solar, wind, hydropower, geothermal, biomass, tidal and bio-fuels"[150] while also noting opportunities and progress to date in other parts of the region. With regards to Fiji, Mohanty discusses projects completed and in the planning stages that are highly relevant to this research, falling under the primary RE sources outlined in the first chapter. Rural electrification projects using solar PV panels date back as far as 1983 and are currently in use across three sites.[151] Governmental investigation and assessment of the potential for implementation of wind generation facilities is on-going, while a NZ company, Delta Renewable Energy, is developing an 8.5 megawatt (MW) biomass facility on the mainland near Labasa.[152] It is notable that, despite this activity in Fiji, most of the progress he mentions, both in larger and smaller states, is limited in scale and focussed on areas such as bio-fuels rather than RE sources producing electricity.[153] Much of the progress towards development of the RE sector is political, with the TERM being a primary example of this, but also with RE specific policy initiatives being undertaken in Samoa, Tuvalu, the Marshall Islands, Palau and

[149] Ibid, 38.

[150] Mohanty, "New Renewable Energy Sources, Green Energy Development and Climate Change: Implications to Pacific Island Countries," 269.

[151] Ibid, 270.

[152] Ibid.

[153] Ibid.

Vanuatu.[154] The political progress outlined shows that there may be some degree of motivation to explore RE technologies and how they might be able to benefit Pacific countries, a point that is important as for any significant transition to occur, there must be impetus from within the region.

The conclusion Mohanty draws, that both environmental and development factors make RE implementation practical and potentially impactful,[155] is important to this research as it indicates that a transition to an energy mix featuring more RE sources and less FF generation could be worthwhile for PICs. His suggestions to help facilitate progress in the RE sector around the Pacific is also in line with other work in the area, with education and effective policy frameworks mentioned as the two pillars that would allow RE sources to flourish and potentially aid in the sustainable development of the region. This feeds into the theme seen throughout this literature review; that local involvement and understanding of RE implementation and its implications is key in both a political and practical sense.

A few themes came through in this literature review. The importance of energy in servicing basic human needs was highlighted in the broader review of energy in the developing world, while certain barriers to implementation of both RE and FF production were introduced here and remained a constant emphasis of the works reviewed in subsequent sections. The sources considered were all consistent in agreeing to the theoretical value of RE sources in development but the practical side was rife with issues, both before implementation could occur and in the long-term after projects had been completed. While FF sources remain uneconomical as a long-term solution, particularly in rural areas, due to high and rising fuel costs and the need to transport that fuel, it was more complicated when considering RE.

[154] Ibid, 270-271.

[155] Ibid, 272.

The first hurdle seems to be the most significant and it occurs at the institutional level. Inadequate policy frameworks and long standing incentivising of FF supply in many developing countries makes investment in RE projects both difficult and unprofitable. Zerriffi and Wilson suggest the GEF as an actor in the RE sector who could help from an institutional and policy point of view. Others look at developed countries with strong RE implementation records as the countries the developing world should base their policy frameworks on. In the Pacific context, NZ is a primary actor in the region with a history of RE implementation, as is Australia. Certain member states of the EU are world leaders in RE technology development and implementation, so would fall under the category of model countries in the RE context.

The secondary issue frequently raised in the literature regarding RE implementation projects was maintenance. The success of these projects once the initial institutional and financial barriers had been cleared was largely dependent on the availability of support and provision of replacement parts. This presents a significant problem in the Pacific context, as the examples in Urmee, Harries and Schlapfer's work showed a greater degree of post project support in the large scale Bangladeshi case than in the smaller Fijian one. This could be a simple case of economies of scale, where bulk buying of parts makes larger scale projects cheaper to support long-term on a unit by unit basis. The emphasis on large scale implementation under the CDM was framed primarily as a means for the country funding the project to gain more CERs, but this may be a secondary explanation for this predilection.

There is a potential solution to both of these issues that is almost universally mentioned in the literature as a strong indicator of the likely success of RE implementation projects. Provision of training and education when introducing RE technologies can help foster community ownership and acceptance while also helping outsource maintenance to local people. The theoretical improvements RE sources can provide to isolated communities in rural or island settings can only come to fruition if they are utilised. Training locals to provide technical support has many

benefits, including reducing long-term costs of having maintenance carried out by individuals who have to travel long distances to installations while also increasing local investment in projects, thus increasing their likelihood of success.

Though recent literature covers the benefits and barriers to RE comprehensively, the concept is anything but new. There were arguments for RE in the developing world[156] and questioning its potential impact[157] over 30 years ago, while the UN published a report in 1987 titled *Our Common Future* which defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[158] and had a heavy focus on energy's role in this. The length of time RE has been espoused as a potential contributor to development without ever gaining widespread traction further illustrates the dichotomy between the theory and practice of RE implementation.

While the literature analysed here was focussed on RE sources there are alternate solutions being promoted. Among these are coal[159] and nuclear[160][161] options for increasing energy supply to the developing world. While these would be impractical in all but the largest Pacific states, due to the dispersal of the population across the region and the effects these technologies would potentially have on the environment

[156] Norman L. Brown, "Renewable Energy Resources for Developing Countries," *Annual Review of Energy* 5(1980).

[157] Andrew McKillop, "Energy for the Developing World: A Critique of the New Wisdom," *Energy Policy* 8, no. 4 (1980).

[158] "Our Common Future," (Oxford: United Nations World Commission on Environment and Development 1987).

[159] Steve Krai, "Developing World Needs Coal," *Mining Engineering* 64, no. 11 (2012).

[160] Ian Lowe, "Can Nuclear Energy Power The Developing World?," *Social Alternatives* 26, no. 2 (2007).

[161] José Goldemberg, "Nuclear Energy in Developing Countries," *Daedalus* 138, no. 4 (2009).

and tourism, these options may be more viable in large developing countries already deeper into the process of development who are looking solely for greater quantity of supply. For the Pacific region, dispersed supply either through FF sources, RE sources or a hybrid system utilising both still seem the most practical solutions to the issue of electrification without compromising supply, security or cost.

Overall, the literature considered here gave a broad summary of the various merits and issues with RE in the context of development, while also helping better understand how effective different methods of implementation are and could be in the future. With regards to the isolated communities of the Pacific region, the articles considered re-affirmed the need for RE implementation to be prioritised from a policy and economic standpoint, so that it can have the impact the theory says it could on populations in need of electrification or cheaper and more secure supply.

Whether these issues manifest themselves in the NZ-Pacific and EU-Pacific policy frameworks that will be examined in the next chapter or within the analysis of the TERM will be interesting to follow. A strong commitment to RE in the Pacific region's dealings with NZ and the EU could help lead it on a path to more effective internal policies in this sector. If increased political dialogue on RE implementation results in some degree of knowledge transfer to PICs, it could help make them more able to harness new sources of energy for their development. Building this type of institutional capacity is mentioned throughout this literature review as an important factor for the success of RE projects, so whether there are instances of funding that go directly to this within the TERM will help show whether the emphasis within academic work on RE implementation in the developing world is reflected in policy and action at a practical level. In addition, provisions for training and involvement of locals in both policy dialogues and project funding are of interest to this research, as they will help to indicate whether external partners such as NZ and the EU still see the provision of development aid as a top down exercise or if they are now looking to foster participation from the bottom up. How projects are supported after the installation of RE supply is also important to the question of whether it can be an

effective tool for development, as the literature indicates that poor maintenance can restrict the long-term impact of initiatives that may initially be successful. In essence, finding out how many of the issues raised in this literature review are considered in the policy and practice of NZ and the EU with regards to the Pacific region can help answer the main query of this research.

Chapter Three: Policy Framework

This chapter is designed to investigate the policy frameworks employed by NZ and the EU in regards to energy, specifically RE promotion and implementation and also more generally how it interacts with the Pacific region from a policy perspective. This analysis will include NZ and EU internal policy documents relating to RE implementation, a look at the organisations and policies through which both entities deal with the Pacific region and finally introduce new institutions that could change the shape of this interaction in the future.

Analysing energy policy documents from both the EU and NZ will give a good overview of their respective positions on RE use both domestically and externally. More specifically, looking at tracts within these documents which show what role both entities see for RE implementation in the developing world will help define the current level of commitment both have for prioritising projects in this sector for the Pacific region. Issues such as the cost of constructing and maintaining RE installations, the scale of implementation envisaged and the emphasis on economic versus social and environmental benefit are all of particular interest when looking at how NZ and the EU might act in this arena globally.

Understanding how NZ and the EU define the region is an important starting point for any analysis of the respective policy mechanisms used in the Pacific context. The legitimacy given to a regional organisation like the PIF over the individual states of the Pacific in EU policy is a key factor when considering how the implementation of alternative energies in the region would work. The multilateral approach the EU typically favours in its external relations would tend to favour this type of organisation, so it is important to see whether the policy emphasis lies with the PIF or with the states of the Pacific themselves. In addition to the PIF, this chapter will examine previous policy documents between the ACP and the EU to see whether energy has been part of the dialogue, particularly in the most prevalent of these, the Cotonou Agreement. For NZ, it would be more logical to look at the traditional bi-lateral relations it has with PICs, as its proximity makes it a part of the region geographically and therefore less likely to deal with Pacific regional groups as an

external partner.

Another factor that results in different approaches to dealing with the Pacific from a policy standpoint is the contrasting internal structures and scale of a nation state like NZ versus a supranational organisation like the EU The EU is a far more significant contributor of development funding than NZ, with contributions from its member states and institutions making it the world's largest provider of aid.[162] While the EU is comprised of many institutions with a role to play in its relations with the developing world, NZ primarily acts externally through its financial aid programme, the New Zealand Agency of International Development (NZAID), within its ministry of foreign affairs and trade. While the Pacific constitutes a far larger percentage of NZ's aid provisions than the EU's, the quantity of aid coming from the EU as well as the different channels it can be fed through makes the EU-Pacific policy framework more complex than is the case for NZ. Analysing these disparate frameworks will help identify the likelihood and potential efficacy of current policy mechanisms utilised by NZ and the EU in relation to the Pacific for the purposes of implementing RE technologies.

Finally, looking at new players in the energy field, particularly as it relates to the developing world, will illustrate new avenues that NZ and EU interaction with the Pacific could take in this sector moving forward. The Global Climate Change Alliance (GCCA) and the International Renewable Energy Agency (IRENA) are two relatively new organisations both of which are focussed on RE promotion with a strong emphasis on the developing world. The GCCA is an EU initiative focussed on political discourse and co-operation on climate change while IRENA is designed to promote and support RE implementation through the sharing of information and best practices and draws funds from both the EU and NZ. As both are interested in

[162] "Aid for Trade to Developing Countries: EU Maintains its Leading Position," (Brussels: European Commission, 2012).

influencing the future of climate change and RE policy in the future, understanding what impact they could have in the Pacific context is important to this research.

European Union

This section will focus on policy documents that have RE as a main thread as a means to finding out how much importance is placed on this topic by the EU. While most EU energy related documents will canvas the issue of sustainability and RE to some degree it is important to be selective and look at those that go towards the goals of this research; discovering whether RE is seen as a legitimate development mechanism and what role the EU would be best suited to in a transition to RE in the Pacific.

An Energy Policy for Europe

This Communication from the European Commission (EC), drafted in 2007, serves as an overview of the major issues facing the EU and its member states in the energy sector as well as outlining some of their short and mid-term goals. There is a strong RE focus within the text as well as sections concerning a couple of the issues to which RE provides a potential solution, EE[163] and reducing GHG emissions.[164] The section referring directly to RE states clearly how and why the EU has fallen short of implementation goals to date: "The main reason for the failure to reach the agreed targets for RE - besides the higher costs of renewable energy sources today compared to "traditional" energy sources - is the lack of a coherent and effective policy framework throughout the EU and a stable long-term vision. As a result, only a limited number of Member States have made serious progress in this area and the

[163] "An Energy Policy for Europe," (Brussels: European Commission, 2007), 11-12.

[164] Ibid, 5.

critical mass has not been reached to shift niche renewables production into the mainstream."[165] This tract accurately summarises two of the dominant narratives on RE globally, that it is too expensive to implement and that it is a contributory solution rather than something more significant, and breaks down the issues facing the EU from a policy perspective, where attempts to unify energy policies and markets are further complicated by the wide array of energy mixes different EU member states have currently. The cost issue is important to the question of RE use in the Pacific too, as high start-up costs can be a barrier to implementation even if there may be a long-term benefit in the form of reduced energy tariffs. Taking this further, if RE is only seen as a contributory solution to the energy problems facing the Pacific, the expense of setting up facilities may not be seen as justifiable. This could create a situation where smaller scale projects are considered fundable but do not have the scope to create tangible benefit, making the contributory solution theory a self-fulfilling prophecy.

The target suggested in the document regarding RE, that 20% of EU energy consumption should be drawn from renewable sources by 2020,[166] not long after it became enshrined in EU legislation as one of three threads in the EU's 20-20-20 targets.[167] The estimated cost of reaching this 20% target is €18b,[168] assuming no cost increase in traditional energy sources and no reduction for renewables. The communication also discusses the need to find a balance between implementation of larger capacity renewable installations now and waiting for research and development to lower their cost in the future.[169] In

[165] Ibid, 13.

[166] Ibid, 14.

[167] "Impact Assessment Document Accompanying the Package of Implementation Measures for the EU's Objectives on Climate Change and Renewable Energy for 2020," (Brussels: European Commission, 2008), 2.

[168] "An Energy Policy for Europe," 15.

[169] Ibid, 13.

summary, this strategic document illustrates the EU's firm commitment to utilising renewable sources while also delineating some of the reasons behind the lack of efficacy in their efforts thus far, including an emphasis on economic benefit that could have implications when applied to the Pacific context.

20-20-20 Targets

The 20-20-20 targets are the main concrete goals of the EU's energy policy and are considered vital to the EU maintaining its role as a leader in combatting climate change. These targets cover GHG emissions and EE in addition to the target directly relating to RE implementation discussed earlier. As these two other issues are tightly interwoven with RE implementation, these targets represent the EU's practical commitment to the strong rhetoric of the EC Communication *An Energy Policy for Europe.* The targets in these two other sectors are a 20% reduction in GHG emissions compared with 1990 levels[170] and a 20% improvement in EE.[171] The significance of these targets is clear; RE use is at the heart of the EU's strategy to establish a reputation as the global leader on climate change. The EU is looking to lead the way as a heavy emitting economy setting ambitious, tangible and measureable targets for itself while others seek to avoid or delay similar commitments. It is clear from even a cursory investigation of the implications of these targets that none can be achieved without significant progress in RE promotion within Europe. While these targets are focussed internally, the fact that the EU wants to be seen as a leader on climate change makes them more likely to take a lead role in promoting RE use in the Pacific. While their own targets are ambitious due to the huge quantity of installed RE capacity it would require, exporting and helping developing countries achieve similar targets would be take

[170] "Impact Assessment Document Accompanying the Package of Implementation Measures for the EU's Objectives on Climate Change and Renewable Energy for 2020," 2.

[171] "The EU Climate and Energy Package," European Commission, http://ec.europa.eu/clima/policies/package/index_en.htm.

less investment while helping uphold the EU's desired reputation as a leader in this sector.

Energy 2020

This 2010 communication from the EC to the other executive branches of the EU designed to lay out the challenges, costs and future course of the European energy market. This document gives an update on whether the EU is projected to succeed in reaching its 20-20-20 targets. While the goal of having 20% of Europe's energy needs met by renewable sources by 2020 is on track to be achieved, the news on the EE focussed goal, reducing total energy use by 20% by 2020, is not so positive.[172] The commitment to reducing GHG emissions by 20% is reaffirmed but no progress report is provided to indicate how this is tracking currently.[173] Some basic numbers indicate why the goal of achieving 20% renewable sourced energy by 2020 is more achievable currently, with levels already at 10% in 2008 and 62% of new energy installations in 2009 being renewable technology.[174] While this is a positive indicator, there are also troubling factors such as the EU becoming a less attractive location for energy related investment than both China and the US[175] and the lack of efficacy in reducing total energy consumption by utilising EE focussed policy instruments at a national level. The overall tenor of this document is concerning and it serves as an urgent call for progress and prioritisation of energy issues both at the EU level and within its member states. While making tangible progress towards RE and EE goals internally is different to attempting to do the same externally, the efficacy of EU policies in advancing this cause is the important point to consider here. Effective policy frameworks were mentioned throughout the literature as an important precursor to RE implementation so how adept the EU is at creating strong

[172] "Energy 2020: A Strategy for Competitive, Sustainable and Secure Energy," (Brussels: European Commission, 2010), 3.

[173] Ibid, 2.

[174] Ibid, 4.

[175] Ibid.

policies in this regard has relevance to their potential of successfully doing the same in the Pacific. Development aid is traditionally provided with a set of criteria designed to push progress along a path amenable to the funding body. If the EU is proficient at creating policy which can engender progress then this could be an area where they could support Pacific nations, for whom policy creation and enactment is likely to be a weakness. Whether this is the case or not is debatable, with the incongruent levels of progress being made on the 20-20-20 targets not really providing a clear picture of whether the EU's policies are having an effect or not.

New Zealand

Energy policy in NZ, similar to the EU, carries a focus on the environmental impact of energy use and on the importance of renewable sources. The scale of the NZ energy market and the abundance of natural resources able to be harnessed for RE production have made implementation far simpler. As a result, NZ already fulfils the majority of its energy needs from renewable sources, with a 2011 report showing 79% of total generation coming from renewable sources,[176] up from 70% in 2007[177] and 73% in 2009.[178] The two most recent NZ energy strategies are the best policy documents to analyse in order to determine the level of commitment to renewable implementation and also will show any changes in emphasis stemming from the change in Government following the 2008 General Election.

[176] "Renewable Electricity Generation Continues to Increase," New Zealand Goverment, http://www.beehive.govt.nz/release/renewable-electricity-generation-continues-increase.

[177] "New Zealand Energy Strategy to 2050," ed. Ministry of Economic Development (Wellington: New Zealand Goverment, 2007), 64.

[178] "Draft New Zealand Energy Strategy: Developing our Energy Potential," ed. Ministry of Economic Development (Wellington: New Zealand Government, 2010), 9.

New Zealand Energy Strategy to 2050

The *New Zealand Energy Strategy to 2050* was released in 2007 and provides an outline of NZ's policy direction over a wide range of energy issues. This document set a target for NZ to have 90% of electricity generation coming from renewable sources by 2025,[179] a goal far in excess of the EU's target of 20% by 2020 but also one that is more easily achievable. The section on renewable electricity generation goes on to discuss NZ's unique position in terms of resource access and affordability, putting it in an advantageous position in regards to creating a low carbon emitting energy market.[180] The issue of long-term environmental benefits versus the visual and noise pollution associated with some renewable sources, with wind farms specifically mentioned,[181] is an important one and something that is highly relevant when looking at implementation options throughout the Pacific region. NZ's reliance on tourism is mirrored and in some instances amplified in many of the island nations of the Pacific. For these countries, consideration of RE installations impact not only on residents but on the natural beauty and tranquillity that makes them such attractive tourist destinations is important. The New Zealand Energy Strategy (NZES) suggests responding to this challenge through consultation on and consideration of each installation to allow a fair compromise to be achieved after a thorough analysis of the hazards and benefits involved. The NZES also outlines the structure of NZ's RE production, namely that it is focussed in three areas: geothermal, wind and hydro generation.[182] Price is cited as the reason other options such as tidal or solar PV are not viable currently[183], an explanation common to the nations of the developed world. This document emphasises keeping NZ at the forefront of any new energy

[179] "New Zealand Energy Strategy to 2050," 22.

[180] Ibid.

[181] Ibid.

[182] Ibid, 23.

[183] Ibid, 22.

technologies or any further developments that may make current renewable sources cheaper through monitoring of progress internationally and promoting greater research collaboration domestically.[184] To this end, the NZES makes the establishment of a funding scheme for marine based and low emission energy implementation projects a priority.[185] Indeed, the Marine Energy Deployment Fund was set up in the same month as the NZES was released, covering the period from 2008-2012.[186] Other costs associated with traditional FF sources, specifically from an emissions trading scheme or from development and use of carbon capture and storage technology,[187] are given as reasons why in the long-term RE promotion is attractive not only from an environmental perspective but also from an economic one. In summary, this document shows a strong commitment to RE use, only showing trepidation at the potential for these intermittent sources to threaten security of supply and thus protecting against that eventuality.

New Zealand Energy Strategy 2011-2021

The new NZES was published in 2011, replacing the 2007 version. It re-affirms RE as a central pillar of the NZES while putting more emphasis on harnessing non-renewable sources as a means to keep power costs down and maintain strong supply.[188] The section dealing with the development of renewables discusses the need for a diverse energy mix to ensure security of supply, with FF generation continuing for the foreseeable future,[189] but also addresses the need to remove any

[184] Ibid, 25.

[185] Ibid.

[186] "Marine Energy Deployment Fund," Energy Efficiency and Conservation Authority, http://www.eeca.govt.nz/marine-energy-fund.

[187] "New Zealand Energy Strategy to 2050," 39.

[188] "New Zealand Energy Strategy 2011-2021," ed. Ministry of Economic Development (Wellington: New Zealand Government, 2011), 2-3.

[189] Ibid, 6.

barriers preventing economically beneficial RE production from occurring.[190] The document reinforces the goal of having 90% of NZ's energy production to come from renewable sources by 2025 but states that "Achieving this target must not be at the expense of the security and reliability of our electricity supply."[191] This represents a perceptible change in the narrative of this NZES and has the potential to change the role NZ could play in the promotion of RE use in the Pacific in two distinctly different ways. On one hand, the increased emphasis on exploring NZ's non-renewable mineral wealth and the need for energy diversity may indicate that involvement in RE promotion overseas would not be a priority for this government. At the same time, the emphasis of the financial dimension of energy production and a distributed energy network inclusive of smaller scale production may lead to more interest in supporting RE projects overseas, where the economic benefits are clear and research on incorporating small scale installations into a widely distributed grid could happen in real time. Without changing any of the RE goals laid out in the 2007 NZES, the 2011 version clearly shifts the narrative from balancing the benefits of intermittent RE sources and security of supply to emphasising the need to explore all energy resources. However, it seems unlikely this change will affect NZ's relations with the Pacific in the energy sector. Even if RE promotion overseas was not a priority, FF production in PICs comes through imported fuels not underutilised resources, which gives the NZES limited benefit as a model policy document for the Pacific region.

Pacific Islands Forum

The PIF is a regional organisation through which the EU can deal with the Pacific region in a multilateral manner. The group includes the two most developed countries in the region, Australia and NZ, as well as most of the smaller island nations of the Pacific; including the Cook Islands, Micronesia, Niue, Kiribati, Nauru,

[190] Ibid.

[191] Ibid.

Samoa, Palau, Papua New Guinea (PNG), Marshall Islands, Vanuatu, the Solomon Islands, Tonga and Tuvalu but excluding French speaking territories of New Caledonia, French Polynesia and Wallis and Futuna.

A project launched in March 2008, funded by the EU and designed to help the management and supply of power, showed a common realisation of the potential for RE to be a solution to energy issues in the Pacific region. This was particularly evident in the assertion that RE sources could help ensure power supply to more isolated rural areas of the Pacific islands.[192] This agreement, while not solely focussed on RE sources, showed that the EU saw the inherent potential for economic development in a move away from FF dependence in the Pacific region

In October 2007, a Special Dialogue meeting was held between the EU and PIF. This was designed to initiate a political dialogue between the highest levels of the PIF and EU.[193] Following this, in September 2008 an EU-PIF Ministerial Troika Meeting was held[194], in a similar fashion to how the EU conducts its dialogue with external partners such as Russia and the United States. A number of traditional EU-Pacific issues were discussed at both meetings, such as governance and economic development,[195][196] but climate change was a significant part of the meetings, including issues surrounding sustainable development and energy.[197][198] An excerpt from the Joint Declaration released following the Nuku'alofa meeting illustrates this growing emphasis on climate change issues: "Considerable attention was paid to

[192] "EU Supports Sustainable Management of Energy Resources in the Pacific Region," (Pacific Islands Forum Secretariat, 2008).

[193] "Joint EU-PIF Nuku'alofa Declaration," (Nuku'alofa: Pacific Islands Forum Secretariat, 2007).

[194] "Inaugural European Union – Pacific Islands Forum Ministerial Troika Final Communiqué," (Brussels: Council of the European Union, 2008).

[195] "Joint EU-PIF Nuku'alofa Declaration."

[196] "Inaugural European Union – Pacific Islands Forum Ministerial Troika Final Communiqué," 2-3.

[197] "Joint EU-PIF Nuku'alofa Declaration."

[198] "Inaugural European Union – Pacific Islands Forum Ministerial Troika Final Communiqué," 4-5.

sustainable development, in particular measures to sustainably manage natural resources, cope with the effects of climate change, and to enhance efforts to address adaptation priorities and mitigation efforts, notably in the area of energy."[199] The next Ministerial Troika Meeting took place in June 2012.[200] The Joint Communiqué released following this meeting included a section specifically relating to RE as a means to reduce FF dependence.[201] In it, increasing the breadth of funding agencies and improving the co-ordination of these through instruments like the Pacific Region Infrastructure Facility was emphasised.[202] Engagement of the private sector within the Pacific region was mentioned as a way to help create new sources of energy supply, while removing subsidies for FF based production would help make RE a more viable option in pure cost terms.[203] These meetings show the multilateral manner in which the EU prefers to deal with the Pacific as well as the commitment to investigating common goals in the climate change and RE sectors.

Another significant milestone in the dialogue between the EU and PIF came with the launch of a *Joint Initiative on Climate Change*, in December 2010. The initiative emphasised the need for the island nations of the Pacific to be able to tackle the impacts of climate change as they are some of the most vulnerable countries in the world in this regard for both economic and geographic reasons.[204] A key part of this was ensuring the Pacific had adequate resources to deal with this threat, with funding from both the EU and its external partners being prioritised for the Pacific region. While the dominant narrative in the text of the *Joint Initiative on Climate Change* was regarding adaptation to and mitigation of the effects of global warming

[199] "Joint EU-PIF Nuku'alofa Declaration.".

[200] "Second Ministerial Meeting Between the Pacific Islands Forum Troika and the European Union Joint Communiqué," (Auckland: European Commission, 2012), 1.

[201] Ibid, 5.

[202] Ibid.

[203] Ibid.

[204] "Commissioner Piebalgs and Pacific Islands Forum Secretary General Slade Launch a Joint Initiative on Climate Change," (Brussels: European Commission, 2010), 1.

there was also a secondary emphasis on RE being an important part of the EUs role in the Pacific region.[205] The promotion of RE is already focus in the island states of Micronesia as well as Niue and Tonga, with projects there being leveraged to decrease reliance on FF sources of energy as well as increase quality of life long-term.

The Pacific Plan

The Pacific Plan is a policy document signed by the members of the PIF in 2005, updated in 2007 and currently undergoing further review. It addresses the numerous barriers to development and threats facing the Pacific region. Its explicit goal is to "Enhance and stimulate economic growth, sustainable development, good governance and security for Pacific countries through regionalism."[206] Included in this are climate change and specifically energy issues. The main thread in regards to energy was implementing the *Pacific Islands Energy Policy*, but within *The Pacific Plan* itself there was reference to the importance of renewable or sustainable energy use, noting "the importance of implementing appropriate policies and programmes to promote an optimal energy mix and energy efficiency supporting sustainable renewable energy."[207] This clear pro-renewable rhetoric shows the members of the PIF see energy issues as a large part of the successful development of the Pacific, to the point of allocating a tract of the Pacific Plan specifically to this topic.

Pacific Islands Energy Policy

The *Pacific Islands Energy Policy* was released in October 2002 with the goal of providing "Available, reliable, affordable, and environmentally sound energy for

[205] Ibid, 2.

[206] "The Pacific Plan for Strengthening Regional Cooperation and Integration," (Pacific Islands Forum Secretariat, 2007), 2.

[207] Ibid, 43.

sustainable development for all Pacific Islanders."[208] This document included a section for RE, which went into the issues surrounding implementation and detailed a plan for the future. They key issues outlined were; lack of practical and managerial expertise, lack of policy emphasis, not enough projects trialling RE implementation, lack of understanding and support both politically as well as within the general population and finally reliance on external financial aid.[209] This section was not purely focussed on the problems with RE in the Pacific, also stating that "Renewable energy sources in the form of hydropower, wind, solar, biofuel, geothermal and ocean thermal hold a lot of potential to be used to promote sustainable social and economic development, particularly in rural and remote areas, while reducing the dependence on FF for power generation and in transportation."[210] While the policies outlined in the section were designed to mitigate the problems and allow the region to enjoy the advantages of RE implementation, the language used was nevertheless conservative. The first policy was designed to lead to "increased use of proven renewable energy technologies"[211], inherently requiring a number of test projects and trial periods before widespread implementation could occur. The third policy aimed to create a "level playing field approach for the application of renewable and conventional energy sources and technologies"[212], rather than giving RE sources priority or incentivising lower environmental impact energy production technologies. The *Pacific Islands Energy Policy* was a fundamentally important document in terms of Pacific co-operation on energy issues and while the understanding of the contextual problems and advantages of RE in the region was a positive sign, the policy solutions offered were limited. This can be linked to the statement about the lack of expertise and understanding of RE within the Pacific, as it is hard for anything to become a point of emphasis policy wise without those preconditions. As

[208] "Pacific Islands Energy Policy and Plan," (Pacific Islands Forum Secretariat, 2002), 2.

[209] Ibid, 9.

[210] Ibid.

[211] Ibid.

[212] Ibid

similar knowledge gaps still exist now in the Pacific, finding effective ways to bridge these should be core to any RE implementation strategy.

African, Caribbean, and Pacific Group of States

Another way in which the EU deals with the Pacific region is through the ACP. As a sub-group within this organisation the Pacific nations involved are called the PACP states. These PACP states include all the members of the PIF, except for Australia and NZ, and also Timor-Leste, a country with observer status at the PIF. As a result, the PIF is the organisation that represents the PACP states in negotiations with the EU.

The Cotonou Agreement

The defining document in the EU-ACP relationship is the *Cotonou Agreement*. In June 2000, the *Cotonou Agreement* replaced the *Lomé Convention*, which had been the regularly updated EU-ACP trade and aid agreement for the past 25 years, with the goal of expanding the scope of relations between the two seen previously. The final *Lomé Convention* period, Lomé IV from 1990 to 2000, gave an indication of the direction the EU wanted to take the relationship, including more internal economic, environmental and even human rights goals for the nations of the Pacific region to achieve. In 1995 the World Trade Organisation (WTO), at the behest of the US and a group of South American states, investigated whether Lomé IV fell within the rules set out by WTO members and a year later decided that the preferential trade conditions the ACP states were receiving could not continue.[213] While the *Lomé Convention* had served a purpose it was clear that a new era of EU-ACP relations was necessary.

[213] "WTO Dispute Settlement: One-Page Case Summaries 1995 – 2011," (Geneva: World Trade Organisation, 2012), 14.

Designed to be a new type of partnership agreement, the *Cotonou Agreement* was a clear break from the tumultuous end of Lomé IV. The major change from an economic perspective was the shift from the trade advantages the ACP states had, which were ruled out by the WTO, to trade pacts and co-operation; in effect still allowing the ACP states the most freedom to access European markets possible but moving away from the trade as aid system the US railed against. Within the preamble, the political expectations for ACP states are laid out clearly with the signatories agreeing that "a political environment guaranteeing peace, security and stability, respect for human rights, democratic principles and the rule of law, and good governance is part and parcel of long term development",[214] while placing responsibilities for fulfilling these goals in the hands of the individual countries comprising the ACP. A deeper reinforcement of the importance of democracy is included later in the text, stating that "democratisation, development and the protection of fundamental freedoms and human rights are interrelated and mutually reinforcing."[215] This type of deep political conditionality was a major development in the transition from Lomé to Cotonou and signalled that EU help was now to come attached with greater expectations. In the future, whether these types of considerations are applied to the energy sector in ACP states could have a significant impact on RE implementation in the Pacific region.

The *Cotonou Agreement* also included specific reference to environmental and energy related issues. Article 32 of the agreement dealt with environmental and natural resource management issues and specific reference is made within this section to both the associated risks of climate change to "small island ACP countries"[216] and the need for schemes addressing RE sources, with solar energy mentioned specifically.[217] One of the most important potential advantages of RE

[214] "Partnership Agreement Between the Members of the African, Caribbean and Pacific Group of States of the One Part, and the European Community and its Member States, of the Other Part, Signed in Cotonou on 23 June 2000," (Official Journal of the European Communities, 2000), 5.

[215] Ibid, 8.

[216] Ibid, 18.

[217] Ibid.

implementation in the Pacific is referred to in Article 43 of the *Cotonou Agreement*, namely that "The Parties [signatories to the Cotonou Agreement] will therefore take measures that will enable inhabitants of ACP countries easy access to information and communication technologies, through…the development and encouragement of the use of affordable renewable energy resources".[218] These references show an emphasis, albeit more in terms of rhetoric than tangible goals, on climate change and alternate energy as issues for the ACP and thus for the Pacific.

The first revision of the *Cotonou Agreement* was concluded in early 2005 and focussed on changes to the political aspect of the agreement, both in terms of maintaining security and managing conflict, as well as material changes to the Investment Facility for ACP states initiated in the original document. For the purposes of this research, the second revision is far more significant, with increased emphasis on climate change issues being a large change in the updated document. This revision, signed in June 2010, changes the section of the document previously dedicated to environmental and natural resource issues, Article 32, and now makes it solely dedicated to climate change. It is now expanded to include references to making the ACP states part of the global carbon market and promoting use of low carbon emitting technologies as well as RE sources.[219] In relation to utilising RE sources as a development mechanism, two notable points about how climate change will be viewed in the EU-ACP relationship are significant. The first was that the two sides would emphasise "integrating climate change into development strategies and poverty reduction efforts"[220], two areas where RE sources could make a difference. Second, the need to raise the political profile of climate change in ACP states through co-operation agreements and policy dialogue was directly mentioned,[221] a step that is clearly necessary to allow RE to rise high enough on the agenda to warrant funding for research, implementation and eventually expansion. The

[218] Ibid, 23.

[219] "The Cotonou Agreement," (Ouagadougo: European Commission, 2010), 45.

[220] Ibid.

[221] Ibid.

changes in the second revision of the Cotonou Agreement bode well for the potential use of RE sources as an aid to development in the Pacific, with consideration given to what changes are necessary both on a political and practical level.

European Union-Pacific Strategy

The first specific EU-Pacific strategy, released in 2006, was designed to delineate the key areas of their relations from the European perspective. Titled *EU Relations with the Pacific Islands - A Strategy for a Strengthened Partnership*, the text covers a number of traditional EU-Pacific issues including governance, fisheries and trade. The reference to RE implementation is brief but interesting, successfully encapsulating the reasons why this concept is particularly advantageous to the Pacific region: "High oil prices, remoteness and small markets are all reasons for the small Pacific islands to place renewable energy and energy efficiency high on their agenda."[222] It went on to state that "Present EC initiatives in this sector could be followed up and expanded, particularly in the framework of the European Union Energy Initiative and of the related EU-ACP Energy Facility".[223] Mentions of climate change in the document largely refer to associated risks to the Pacific region and discuss mitigation in general terms. This document accurately depicts the substance of the EU-Pacific relationship during most of the past decade – climate change growing as an issue, RE projects mentioned as a part of development but traditional economic and political issues still taking centre stage.

Following this in 2012, the EC released a new strategy titled *Towards a Renewed EU-Pacific Development Partnership*. Energy issues are featured in this text and securing and extending supply is understandably given highest priority. RE is only mentioned briefly as an alternative source of power rather than as a part of the solution to the

[222] "EU Relations with the Pacific Islands - A Strategy for a Strengthened Partnership," (Brussels: European Commission, 2006), 10.

[223] Ibid.

aforementioned energy issues.[224] With a primary focus on climate change adaptation, this document did little to extend EU-Pacific relations on RE or gain a better understanding of how co-operation between the two on this issue may take shape.

Pacific Economic Partnership Agreement

The concept of a Pacific EPA is not a new one. Negotiation of this Pacific EPA has been on-going since September 2004[225] and to date only an interim EPA has been agreed to between the EU and two PACP states, PNG and Fiji, in late 2007.[226] In 2009, both PNG and Fiji have signed their interim EPA[227] while issues surrounding trade provisions and fisheries continued to hold up a full EPA with all PACP countries[228]. In theory, a completed agreement would replace provisions in the *Cotonou Agreement*[229], which are necessarily compromised in order to encapsulate the needs of all ACP states as best possible. This means certain issues particularly relevant to the Pacific region remain unaddressed within Cotonou. The extended negotiations and current impasse between most PACP states and the EU is partly due to differing views on what these Pacific focussed needs actually are. As articulated by Dr. Malakai Koloamatangi in his article *EU, Cotonou and EPAs: the View from the Pacific Islands* almost a decade ago, any agreement will need to

[224] "Towards a Renewed EU-Pacific Development Partnership," (Brussels: European Commission, 2012).

[225] "Trading for Development: An European Union - Pacific Economic Partnership Agreement ", (Luxembourg: European Commission, 2007), 12.

[226] "Fact Sheet on the Interim Economic Partnership Agreements: The Pacific: Fiji and Papua New Guinea," (European Commission, 2009).

[227] "Pacific EPA," ed. Directorate-General for Agriculture and Rural Development (European Commission, 2010), 1.

[228] Ibid.

[229] "EU Relations with the Pacific Islands - A Strategy for a Strengthened Partnership," 25.

consider "the breadth and depth of the Pacific as a region and individually, and the common and unique conditions contained within such characterisations."[230] This makes a quick resolution seem unlikely.

Regional and Country Strategy Papers

Any funding directed into the Pacific region is currently drawn from the 10th European Development Fund (EDF). This same system has been running since before the Lomé Convention and its iterations have tended to follow the updates of both Lomé and Cotonou since its inception. The 10th EDF has a total budget of €22.7b and runs from 2008 through to 2013.[231] The EDF is almost entirely dedicated to funding development and assistance programmes in ACP states, with €22b of the total budget allocated to them.[232] Of this amount, the majority is committed to national and regional indicative programmes with intra-regional co-operation as a secondary focus.[233] The 10th EDF also represents a much larger investment that previous versions, with the 9th EDF offering €13.5b over a longer seven year term, from 2000-2007.[234] The EDF is effectively the means by which the goals of the *Cotonou Agreement* are to be reached.

[230] Malakai Koloamatangi, "'EU, Cotonou and EPAs: the View from the Pacific Islands.'," *The Courier* 2003, 14-15.

[231] "European Development Fund." European Commission, http://ec.europa.eu/europeaid/how/finance/edf_en.htm.

[232] Ibid.

[233] Ibid.

[234] "European Development Fund," European Commission, http://europa.eu/legislation_summaries/development/overseas_countries_territories/r12102_en.htm.

A new feature of the 10th EDF is the inclusion of incentive amounts. These are extra resources that ACP states can gain by meeting various political conditionality clauses in the *Cotonou Agreement*. The main area of emphasis for gaining these incentive amounts is progress in a countries adherence to the rule of law and good management of financial and tax systems.[235] This innovation could be particularly relevant to RE implementation, as a similar incentive scheme could drive progress in this sector. As they have implemented in regards to political conditionality, rewards for progress on meeting the energy goals set for ACP states in Article 32 of the *Cotonou Agreement* could be an effective way to engender change. RE promotion should have similar importance to the EU as good governance and rule of law provisions, as the tangible benefits in terms of quality of life and environmental protection are evident while also providing the EU a similar level of legitimacy as an organisation capable of spreading its values throughout the developing world.

Under both the 9th and 10th EDF, each region of the ACP has its own Regional Strategy Paper (RSP). Looking at these documents for the Pacific region during the 9th EDF versus the 10th EDF may give an indication on how the narrative on RE is shifting. The Pacific RSP under the 9th EDF covers the period 2002-2007 and has a strong focus on the effects of urbanisation and adaptation to the on-going threats of climate change.[236] The document includes statistics on the total resource allocation to the Pacific broken down into various sectors, with energy receiving €10.7m of the total €165.4m provided to PACP states between 1975 and 2002.[237] The document mentions French aid to the Pacific being focussed on RE initiatives, but this occurs outside the EDF.[238] The Pacific RSP under the 10th EDF has a more expanded section on the environmental situation in the region, with inclusion of traditional

[235] "European Development Fund," European Commission, http://ec.europa.eu/europeaid/how/finance/edf_en.htm.

[236] "Pacific ACP - European Community Regional Strategy Paper and Regional Indicative Programme for the Period 2002-2007," (European Commission, 2002), 23-24.

[237] Ibid, 27.

[238] Ibid, 28.

environmental considerations such as biodiversity, pollution and resource use alongside the need to manage risks associated with climate change like sea level rise and increased extreme weather events. When environmental issues are brought up again as part of the dialogue on sustainable development in the Pacific, the dichotomy between the contributions the PACP states make to the climate change problem and the degree to which the effects of global warming will affect them is discussed.[239] In addition this section outlines agreements, such as the *Pacific Islands Framework for Action on Climate Change*, and organisations, such as the Pacific Climate Change Roundtable, that have been utilised by the nations of the Pacific in a co-operative manner in order to meet their climate change related obligations.[240] In the same sustainable development section of this RSP is tract relating directly to energy, in reference to improving both energy efficiency (EE) and RE use, two intrinsically linked topics. The *Pacific Islands Energy Policy* is mentioned as an important document which aims for greater access to energy for all Pacific Islanders as well as providing this energy in an environmentally responsible way.[241] To fulfil the goals of this document, an initiative called Pacific Islands for Sustainable Development has been set up and under this the Danish government, through the European Union Energy Initiative, has funded a project to improve various parts of the energy sector in the Pacific.[242] Looking at these two documents drafted only half a decade apart, we can see that energy issues, particularly RE use, are a growing part of the EU-Pacific relationship.

In addition to these RSPs, each individual ACP state has its own Country Strategy Paper (CSP). The only exception within the PACP states is Fiji, likely excluded due to their current political situation. For nine of the remaining 14 PACP states, RE is a major part of their CSP. The Marshall Islands, Federated States of Micronesia,

[239] "European Community - Pacific Region Regional Strategy Paper and Regional Indicative Programme 2008-2013," (European Commission, 2008), 40.

[240] Ibid.

[241] Ibid, 41-42.

[242] Ibid, 42.

Nauru, Palau and Niue all had energy as a focal point under the 9th EDF while Tonga, the Cook Islands, Kiribati and Tuvalu join these initial states in having RE as a focus under the 10th EDF. In Tonga, the National Indicative Programme, which is designed to help implement the CSP, is to be focussed purely on RE during the 10th EDF.[243] In the case of the Federated States of Micronesia, €7.5m of the total €8.3m in development money is to be put towards developing RE,[244] a logical choice given that the country is comprised of 65 inhabited islands, making traditional FF sources even more costly and impractical than elsewhere in the Pacific. The Marshall Islands CSP includes the following tract: "Addressing the basic energy needs of the outer islands through a sustainable, environmentally sound and secure energy supply can supplement the long-term energy needs of the country and reduce the dependence on imported fossil fuels."[245] The Marshall Islands, Palau and Nauru are to direct 85% of their main funding package towards RE projects, around €4.5m total for the Marshall Islands,[246] €2.5m for Palau[247] and €2.3m for Nauru.[248] Niue is allocating €2.5m to improving EE as well as RE projects.[249] The Cook Islands CSP highlights an "urgent need to develop alternative and RE sources, especially on the outer islands",[250] while Tuvalu's includes increasing RE use as part of its focal funding

[243] "Kingdom of Tonga - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 4.

[244] "Federated States of Micronesia - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 4.

[245] "Republic of the Marshall Islands - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 4.

[246] Ibid.

[247] "Palau - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 4.

[248] "Government of Nauru - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 4.

[249] "Niue - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 22.

[250] "Cook Islands - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 47.

sector.[251] Kiribati has the development of a RE policy as a policy goal within its CSP,[252] to change a previous lack of priority placed on this sector.[253] These high level commitments are an encouraging sign that RE is being seen as a viable and important part of both economic and social development in the Pacific region.

However, this group is made up of the smaller states, in terms of land mass and population, in the region where implementation of RE projects would be on a smaller scale and thus more manageable. The countries with CSPs that do not have RE as a focus; PNG, Timor-Leste, Samoa, the Solomon Islands and Vanuatu, all have a significantly higher population size than any of the energy focussed group. While the uptake of RE as a policy focus by the majority of PACP states is a positive, the lack of prioritisation by the larger states in the region is not. The scale of initial RE projects in the Pacific has been necessarily small but to affect change on quality of life throughout the region, large scale projects in the most populous of these island nations should be a focus for the future.

The ACP-EU Energy Facility is an important mechanism for the potential implementation of RE in the Pacific funded directly from the EDF. An EC communication in 2004 outlined the form this would take and the ACP-EU Energy Facility was established in 2005.[254] Within the EC communication, the potential for RE to reduce energy costs in small island countries, where the need to transport raw FF leads to energy costs four to ten times higher than the average cost

[251] "Tuvalu - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (European Commission, 2007), 37.

[252] "Kiribati - European Community 10th EDF Country Strategy Paper and National Indicative Programme for the Period 2008-2013," (Nuku'alofa: European Commission, 2007), 25.

[253] Ibid, 44.

[254] "ACP-EU Energy Facility," European Commission, http://ec.europa.eu/europeaid/where/acp/regional-cooperation/energy/index_en.htm.

internationally,[255] is explicitly mentioned with it being highlighted as an area where implementation could do the most good and therefore should be prioritised. The first ACP-EU Energy Facility was part of the 9th EDF, with a budget of €220m,[256] and funded 74 projects in the energy sector.[257] The second ACP-EU Energy Facility is funded under the 10th EDF and has a slightly smaller budget of €200m and is currently funding 65 projects selected not long after its implementation in 2009.[258] The ACP-EU Energy Facility has been an effective tool thus far in making practical gains in various ACP states and it has the potential to be a driving force behind the large-scale implementation of renewable energies in the Pacific.

NZAID

NZ's aid contributions are small relative to other OECD countries on a per capita basis. In comparison with the EU, NZ has far less ability to influence change through funding multiple large scale projects across a range of emphases. Nevertheless, the Pacific is the predominant focus of NZAID and because of this, along with the role afforded due to geographical proximity to the region, NZ is a major part of Pacific development. In 2004, NZ$122m of the total NZ$260m budget of NZAID went to the PICs, making it the fourth largest provider of aid to the Pacific region.[259] Currently, the Pacific Region receives over 50% of all funds under the New Zealand Partnerships for International Development Fund.[260] This illustrates the strong commitment to the Pacific region and the emphasis on acting within PICs shows that NZ sees itself as a leader in this context.

[255] "On the Future Development of the EU Energy Initiative and the Modalities for the Establishment of an Energy Facility for ACP Countries," (Brussels: European Commission, 2004), 14.

[256] "ACP-EU Energy Facility".

[257] Ibid.

[258] Ibid.

[259] "The Pacific Fact Sheet," (Wellington: New Zealand Agency for International Development, 2004), 1.

[260] "Partnerships Fund Criteria".

Within this broader commitment to the region, NZ has some specific responsibilities which fall under the NZAID umbrella. First and foremost are the countries in free association with NZ, Niue and the Cook Islands, as well as Tokelau, which is a territory of NZ. These states receive per-capita funding far in excess of any other PICs.[261] Outside of this, NZAID has focussed on development in the most populous sub-region of the Pacific, the Melanesian states of PNG, the Solomon Islands and Vanuatu, while Tonga and Samoa receive the most funding among Polynesian states.[262] In total, NZAID provided assistance to ten PIF member states in the 2011-2012 period[263] and plans to expand this to 11 in the 2012-2015 period.[264] This broad funding from NZ in the Pacific region re-enforces its attempts to be a leader within the region despite its relatively small aid budget.

Of the ten currently funded PIF member states, seven have policy frameworks with NZ which are called the Joint Commitment for Development (JCD) agreements. In addition to these those within the PIF, Tokelau has a JCD due to its special relationship as a territory of NZ. These documents detail the responsibilities of each party in regards to their relationship in the development sphere. Of the eight JCD agreements, five feature goals specifically relating to the energy sector. The PNG JCD discusses energy in terms of increasing electrification, providing up to US$2.5m to connect households, schools and medical facilities to the electrical grid while also reducing domestic spending on energy by 20%.[265] This relates to the point made by Urmee et al. in the academic work on energy in the Pacific region, that electrification

[261] "Aid Allocations 2011/2012," New Zealand Agency for International Development, http://www.aid.govt.nz/about-aid-programme/aid-statistics/aid-allocations-20112012.

[262] Ibid.

[263] Ibid.

[264] "Indicative Programme Allocations 2012/13 - 2014/15," New Zealand Agency for International Development, http://www.aid.govt.nz/about-aid-programme/aid-statistics/aid-allocations-201213-201415.

[265] "New Zealand – Papua New Guinea Joint Commitment for Development," (Perth: New Zealand Agency for International Development, 2011), 8-9.

is a primary issue.[266] However, the PNG JCD does not include RE implementation as part of the potential solution. The Cook Islands, Samoa and Tokelau JCD agreements all have RE as a focus as a means to reduce reliance on FF sources for energy.[267][268][269] In the Samoa and Tokelau JCD agreements, the commitment does not go past this type of cursory mention of RE, but in the Cook Islands agreement, NZ commits to helping develop a Renewable Energy Chart and then fund projects to meet the goals of this document, including an increased level of RE production.[270] The Tonga JCD is the only one to introduce RE targets separate to the desire to reduce FF dependence. It outlines funding for the construction of a 1MW solar PV plant and for upgrades to the grid on the main island of Tongatapu as well as non RE goals of training 64 linesmen in Tonga to a NZ standard and bringing a further 180 households onto the grid.[271] These non-RE goals are significant as they highlight another point made by Urmee et al., namely the importance of training and knowledge transfer as a precursor to implementation.[272] The agreement with Tonga also specifically mentions the possibility of future funding under the TERM,[273] the subject of the case study in this thesis. These JCDs show that energy is a part of the dialogue between NZ and the Pacific region but that this is not universal and in some cases does not extend beyond political rhetoric.

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[266] Urmee, Harries, and Schlapfer, "Issues related to rural electrification using renewable energy in developing countries of Asia and Pacific," 355.

[267] "New Zealand – Cook Islands Joint Commitment for Development," (Rarotonga: New Zealand Agency for International Development, 2011), iv.

[268] "New Zealand – Samoa Joint Commitment for Development," (Apia: New Zealand Agency for International Development, 2011), 2.

[269] "New Zealand – Tokelau Joint Commitment for Development," (New Zealand Agency for International Development, 2011), 1.

[270] "New Zealand – Cook Islands Joint Commitment for Development," iv.

[271] "New Zealand – Tonga Joint Commitment for Development," (Nuku'alofa: New Zealand Agency for International Development, 2011), 5.

[272] "Issues related to rural electrification using renewable energy in developing countries of Asia and Pacific," 357.

[273] "New Zealand – Tonga Joint Commitment for Development," 5.

Global Climate Change Alliance

The GCCA is an organisation created in 2007 to facilitate progress on climate change issues in the LDCs and SIDS who are most vulnerable to the effects of climate change, a definition that incorporates all PACP states on both counts. While the GCCA is mainly focussed on climate change adaptation for these at risk states, one of the five focal points for this organisation is to increase the level of CDM investment in these LDCs and SIDS.[274] This is a clear area where RE projects, funded by companies in Europe in order to achieve their targets under the EU Emissions Trading Scheme, could come to the fore. To date, the use of the CDM in these countries has been minimal, but when looking at the potential for both small and large scale RE projects, the Pacific region is a perfect candidate. It is already a policy emphasis in their RSP with the EU as well as many of the individual state CSPs and the technical and managerial expertise deficit in many of these countries is an issue European energy companies could help deal with.

International Renewable Energy Agency

The creation of IRENA was a long process. The idea for an IO focussed solely on RE was first mooted at a United Nations conference on New and Renewable Sources of Energy in 1981,[275] yet the first concrete movement towards IRENA as it is constructed today didn't occur until 2004 at the International Conference for Renewable Energies, which recommended the formation of IRENA in its summary document.[276] The next step was a series of preparatory meetings in 2008, involving representatives from a wide range of countries creating the momentum required for IRENA to come into being, if not yet delineating all the finer points of what the

[274] "What is the GCCA?," Global Climate Change Alliance, http://www.gcca.eu/about-the-gcca/what-is-the-gcca.

[275] "Creation of IRENA," International Renewable Energy Agency, http://www.irena.org/menu/index.aspx?mnu=cat&PriMenuID=13&CatID=30.

[276] Ibid.

organisation would look like or how it would function. The goal coming out of these meetings was that "IRENA should be become the very first intergovernmental organisation on a global scale dedicated towards the promotion of renewable energy".[277] These meetings led directly to the IRENA Founding Conference in January 2009, where the organisation was officially brought into existence.

In addition to the practical political dialogues and meetings that led to the creation of IRENA, it is important to consider other factors that produced the impetus for such an organisation to be formed. Namely, what motivated so many countries to come together in forming this organisation and why they felt this would be the best way to serve their RE promotion goals both individually and as a collective. The core reasons for the foundation of this organisation almost all apply to the developing world more so than equally FF source reliant developed nations. The reasons for IRENAs core belief in the vital role of RE going forward are than it can: improve energy security, help mitigate climate change, reduce energy poverty, aid in sustainable development efforts and help fuel economic growth.[278] The focus on Africa and the Pacific as regions that could benefit most from RE use is accurate from a quality of life point of view, helping energy supply, cost and security in places were all three are major problems. Claiming this will help mitigate climate change to any significant degree seems less credible, as the low levels of energy use in both regions means even a widespread conversion to RE sources or supplementation of FF based generation would have a negligible effect on climate change globally. From this we can ascertain that the member states of IRENA are interested in it primarily being a force for spreading RE to places where energy is a basic issue rather than having it deeply affect energy policy and production in countries with established energy supply and good security and cost.

[277] Ibid.

[278] "IRENA Vision and Mission Statement," (Abu Dhabi: International Renewable Energy Agency), 1.

Significantly increasing the share of renewable sources to the developed world, particularly Europe and the United States, where climate change may be able to be effectually mitigated is a secondary goal for IRENA, as it would be a more complex political issue. While rhetoric surrounding all member states of IRENA increasing the share of RE sources internally, as well as promoting and supporting its implementation internationally, is included,[279] binding targets are not yet a feature. Both of these factors, the emphasis on promotion of RE in the developing world and not requiring any binding commitment to immediate renewable implementation internally, go some way to showing why IRENA has such widespread participation and membership. If membership in IRENA were to include provisions that would require domestic policy changes that could negatively affect the popularity of national governments, this collective effort would likely not exist. The question of whether IRENA eventually looks to reach deeper into issues with its heavier power consuming members to actually fulfil its goal of helping mitigate climate change will likely remain unanswered for some time. Nevertheless, an organisation focussed on affecting change in the energy reality of regions which truly need the help is better than the previous status quo, even if internal implementation for its more developed members remains voluntary.

In January 2009, the Statute of IRENA was signed, establishing the organisation officially, setting out its underlying principles, goals and desired actions. The basic message of IRENA is to do everything in its power to spread RE, both through encouraging and facilitating implementation projects and expounding the benefits of these energy sources through education and allowing easier communication within the network of IRENA member states. The objectives outlined under the broader spectrum of RE promotion included taking any effect implementation could have on economic growth and poverty alleviation into account,[280] two potential benefits which could be crucial for Pacific development. The document outlines how IRENA

[279] Ibid, 2.

[280] "Statute of the International Renewable Energy Agency," (Bonn: International Renewable Energy Agency, 2009), 4.

will bring together current knowledge on RE in terms of policy, technology, financing and risk factors[281] for the benefit of its members as well as promoting and encouraging further research into the socio-economic dimension of RE implementation.[282] Furthermore, it states the intent of IRENA members to have the agency act as a common voice on RE issues. The statute includes specific allowances for geographically challenging situations as found in the Pacific region, stating that IRENA will operate while "bearing in mind the special needs of the developing countries, and remote and isolated regions and islands".[283] An early example of this is the work IRENA has done with the PPA on the effects of RE implementation of electrical grids within the Pacific region.[284] IRENA could be a unique IO which can help PICs meet the political requirements for RE implementation, particularly in terms of increasing institutional and policy strength within the region, but this will require a deep engagement in the region. Its role will be further investigated in the case study on the TERM.

NZ and the EU both have diverse and far reaching policy frameworks for interacting with the Pacific region. Political dialogue taking place with regards to the PIF, for NZ internally as a member and for the EU in meetings and negotiations with the organisation, constitute an important thread of NZ and EU relations with PICs. The internal emphasis on RE in EU energy policy documents shows the type of commitment that makes it a global leader on climate change issues. The extensive and long-standing policy links it possesses with the Pacific region through the PIF and ACP mechanisms gives it an ability to have an extensive impact on the energy issues of PICs, particularly with regards to reducing FF reliance through promoting and funding RE projects in the region. While NZ internal energy policy in recent years balances promotion of RE with the need for affordable and secure supply, the

[281] Ibid, 5-6.

[282] Ibid, 6.

[283] Ibid, 7.

[284] "Joint IRENA-PPA Workshop: Assessment of Grid Stability for Increased Renewable Energy Integration in the Pacific Region."

high percentage of electricity created from renewable sources and the knowledge base and expertise that exists because of this shows how NZ could add value to the energy sector in the Pacific region. NZAID's strong support of many PICs gives it a pre-existing relationship that could easily be extended to energy issues for those where it has not yet been prioritised or deepened in those states where RE has already been shown to have a clear and demonstrable benefit.

The linkages between the focal points of the policy documents analysed here and the literature examined in the previous chapter is also interesting to consider in light of the main research question. Both understand and emphasise the importance of strong internal policies and implementing agencies if RE is ever to be an effective mechanism for development so it will be intriguing to see if the bulk of funding within EU-Pacific and NZ-Pacific relations is directed at implementation or capacity building. The efficacy of funding in regards to the TERM will be relevant as an indication of whether RE can have a significant impact on facilitating development and how large an obstacle the lack of internal expertise is in practice.

Chapter Four: Case Study

The Tonga Energy Roadmap

This chapter will look at the TERM as a case study for the implementation of RE sources of energy in the Pacific region. The reasons for choosing the TERM as a focus for this case study are related to both the goals set forth in the document and the methods being utilised to achieve these goals. With this plan, the Government of Tonga (GoT) has committed to alternative energy in a more emphatic and extensive way than any of its Pacific neighbours. The goals set out under the TERM are ambitious but the widespread electrification of the country, genuine need for reduced electricity tariffs and a reasonably long time frame should provide all the motivation and conditions needed for real progress to be made before the plan expires.

Another important factor in selecting Tonga and the TERM as subjects of this case study is the involvement of IRENA. IRENA is a new organisation which could have a strong impact on the making the possibility of widespread alternative energy use in the Pacific a reality. How engaged this organisation is in the TERM could have a tangible impact on whether the theory behind using alternative energy as a tool for development can be effective in practice. If IRENA remains on the periphery while more traditional development bodies come to the fore, it would indicate that the organisation is seen as playing more of a supporting role. However, if IRENA becomes a central cog in the execution of the TERM, it would show that it is more than a political exercise and may represent a tangible change in how RE implementation and sustainable development are promoted across the globe.

The basic aim of this chapter is to find out whether the TERM is delivering quality outcomes early in its ten year term and whether this model of implementation could be applicable for other Pacific nations both from a structural and funding standpoint. This chapter will begin with an analysis of Tonga's energy needs and sources, followed by an investigation of the structure and funding of the TERM. Whether the EU or NZ plays a primary role in the implementation of the TERM either within or outside the auspices of IRENA is of interest, due to what this might indicate about bi-lateral relations on RE between the EU or NZ and the Pacific. The investigation will

not only be focussed on NZ, the EU and IRENA however; the participation of all countries and bodies involved in the TERM will illustrate how practical implementation of RE is currently undertaken and what participation model might be best if similar projects are carried out within the Pacific region in the future.

Tonga Energy Facts

Certain conditions found in Tonga but not in other areas of the Pacific region have made it an idea candidate for an implementation project like the TERM. Most important among these is the high level of electrification in Tonga. Around 85% of the Tongan population has access to electricity,[285] far higher proportion than is found in most PICs. This means that there is an electrical grid reaching most of the population and therefore pre-existing infrastructure for new RE production to feed into. The state owned national energy provider, Tonga Power Limited (TPL), has a reputation as one of the best in the region,[286] a fact which should help smooth the process of implementing the TERM. TPL is the sole supplier of electricity in Tonga, which should streamline the process of implementing new sources of power as negotiating with one company is far simpler than dealing with a range of providers all with their own interests. As of 2012, TPL had a total grid based capacity of around 14.3MW serving a total demand in that year of 52.4 gigawatt hours.[287] This is spread across four grids on the islands of Tongatapu, ʻEua, Ha'apai and Vava'u

A quality Tonga does have in common with its Pacific neighbours is a reliance on diesel generation for electricity. Before 2012, all grid supplied electricity in Tonga was derived from imported diesel fuel and 98% of all electricity consumption comes

[285] Mark Fogarty, "Balancing Energy Reform in the Kingdom of Tonga," (Renewable Energy & Efficiency Partnership, 2012), 5.

[286] Ibid.

[287] "Outer Island Energy Efficiency Project," (Asian Development Bank, 2013), 2.

from this source.[288] As a result, fuel makes up around 25% of all imports,[289] which leads to energy tariffs being left totally vulnerability to price fluctuations. In July 2012, a 1MW solar power plant was opened on Tongatapu, and this is now reflected in the energy mix shown on the TPL website.[290] The funding and installation of this plant will be discussed later along with other implementation projects.

Tonga is particularly susceptible to supply chain costs in relation to its electricity generation. With a population spread across 36 islands and the heavy reliance on diesel fuel for generation, transportation of fuels adds greatly to the cost of generating power, which means that electricity tariffs in Tonga are among the highest in the region. As of April 2013, Tongans on all four main islands pay 94 seniti, equivalent to approximately US54c, per kilowatt hour (kWh) of power used.[291] This follows a price rise of just over 10% from 85 seniti due to increasing cost of imported diesel fuel.[292] This was even higher in the recent past as in 2008, fuel costs rose steeply and the electricity tariff topped 1 pa'anga.[293] By comparison, consumers in NZ pay an average of just under 28c NZ per kWh,[294] which equates to approximately US23c, while in Fiji the domestic tariff is just over 33c Fijian,[295] or around US18c. This not only makes the cost of basic heating and cooling high in Tonga, it also makes uptake of new appliances and technologies expensive, often prohibitively so.

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[288] "Tonga Energy Road Map 2010-2020," (Nuku'Alofa: Government of Tonga, 2010), 2.

[289] Ibid.

[290] "About Tonga Power Limited," Tonga Power Limited, http://www.tongapower.to/AboutUs.aspx.

[291] "Electricity Tariff Increase Effective from Consumption After 15 April 2013," Tonga Power Limited, http://www.tongapower.to/NewsRoom/tarrif_increase_april2013.aspx.

[292] Ibid.

[293] "Tonga Energy Road Map 2010-2020," 3.

[294] "Domestic Electricity Prices Available Up To 15 Feb 2013," ed. Ministry of Economic Development (New Zealand Government, 2013).

[295] "Public Notice," ed. Fijian Energy Authority (2013).

In summation, the broader access to electricity and higher tariffs found in Tonga compared to other PICs makes it a good candidate for a plan like the TERM. The reliance on diesel generated power is not unique to Tonga but as one of the larger countries in the region and one with a widely dispersed population, reducing reliance on this fuel source and the price variations that come with it is a high priority. An effectively implemented TERM would help with these issues, creating a lower and more stable energy tariff for on-grid customers while also potentially helping the non-negligible minority deriving power from non-grid sources.

Tonga Energy Road Map

The TERM is the result of a government initiative designed to increase energy security and decrease carbon emissions within Tonga. It was completed in June 2010 and acts as a comprehensive guide towards a renewable focussed energy sector for Tonga. The TERM calls for a multifaceted approach to energy supply and cost issues. As well as developing renewable sources to plug into the grid, there is also a focus on ways to reduce the high cost of petrol based energy sources through increasing efficiency of generation and reducing cost variance and overall expense through supply chain improvements.[296] EE is also a core component of the TERM, with promotion of energy saving measures to the population of Tonga seen as having an important role to play. Overall, this plan is innovative and important both for Tonga and as a possible model for implementation in other countries within the region.

In addition to the rhetoric on reducing energy prices and carbon emissions, the TERM includes more tangible goals and ways of achieving these. It outlined an ambitious target of deriving 50% of Tonga's grid based electricity supply from RE sources by 2012[297] and sets out the framework of a least cost programme for

[296] "Tonga Energy Road Map 2010-2020," 6.

[297] Ibid, 4.

realizing this goal. The rationale behind using a least cost approach was to reach the 50% target as soon as possible.[298] If this target was reached, TPL estimates the electricity tariff would reduce by 25 seniti,[299] which is a reduction of over 25%. Landfill gas and wind generation are stated to be the cheapest options with solar PV and using coconut oil as a diesel fuel substitute listed as the next best options.[300] Only mature RETs were considered for the TERM,[301] so newer developing sources such as ocean energy generation, which may become viable options well suited to PICs in the future as costs decline, were not considered. Other limitations of intermittent sources like wind and solar are explained, with the problem of varying diesel generated supply to match output from these RE sources and continue to service customer demand.[302] This limits the amount of combined wind and solar resources that can be installed at present, with the TERM final report setting this at 2.4MW of solar PV generation or 1.4MW from wind on the main island of Tongatapu, where 85% of total energy is consumed,[303] before it would likely cause problems.[304] This gives sources such as landfill gas and the use of coconut oil as a fuel source and advantage from an ease of implementation point of view, although the total capacity of these technologies, particularly regarding coconut oil, was undetermined at the time the TERM final report was released.[305] In addition to discussion of potential RE solutions to high electricity tariffs, measures such as reducing supply chain costs[306] and increasing supply side efficiency[307] to generate as much electricity

[298] Ibid, xiv.

[299] "The Official Dedication of Maama Mai Solar Farm Facility by His Majesty King Tupou VI.".

[300] "Tonga Energy Road Map 2010-2020," xiii.

[301] Ibid, 33.

[302] Ibid, 34.

[303] Ibid, 17.

[304] Ibid.

[305] Ibid, 37.

[306] Ibid, 26.

[307] Ibid, 30.

from FF sources as possible were raised in the TERM. This shows the type of multi-faceted approach the TERM looks to foster, with improvements to old forms of electricity generation being carried out alongside the implementation of new sources.

The final report introduces two bodies which are to be primarily responsible for the execution of the TERM. Since then, a further body has been introduced relating specifically to deal with energy issues under the TERM. The TERM Committee is a political body comprised primarily of Tongan Government Ministers, designed to oversee decisions made in relation to the TERM. TPL is also represented on the TERM Committee, along with the Ministers of Finance, Labor and Commerce, Lands, Survey and Natural Resources, Environment as well as representation from the Prime Minister's office.[308] The TERM Final Report first laid down expectations of weekly meetings to discuss issues related to the road map[309] and also calls for monthly meetings with a wider project monitoring and coordinating committee and bi-annual involvement of development partners.[310] This group will ideally analyse the direction of the TERM and ensure that progress in the right direction is happening at the political level. In April 2012 the TERM Agency was created by the Tongan Cabinet.[311] This body has the responsibility of overseeing energy projects with the TERM and reports directly to Cabinet.[312] The Tonga Energy Road Map Implementation Unit (TERM IU) is the group tasked with more hands on management and day to day running of the TERM. Headed by a Road Map Coordinator, the TERM IU reports to the TERM Committee monthly on the speed and quality of progress at a practical level but is funded externally so it can remain an

[308] Ibid, 12

[309] Ibid.

[310] Ibid, 53.

[311] "Project Paper for Small Recipient Executed Trust Fund Grant US$2.90 Million Equivalent to the Kingdom Of Tonga for an Energy Roadmap Institutional and Regulatory Framework Strengthening Project," (World Bank, 2012), 17-18.

[312] Ibid.

independent body. [313] The responsibilities of the TERM IU include: managing reviews of the policy, regulatory and legal issues related to the TERM and helping to create an enhanced institutional framework for its implementation, working with TPL on power loss minimisation projects and ensuring provision of relevant training for local staff.[314] This body has many other responsibilities related to more technical aspects of management and communication with parties involved in the TERM but the tasks listed above represent priorities that are in line with academic work on development and the conditions required for success. The primary focus on increasing capacity within GoT institutions and ensuring effective reviews of relevant policy are particularly interesting aspects, as the type of deficits developing countries have in this regard is mentioned as a barrier to RE implementation within the literature on energy and development.[315] As a result, the TERM IU would appear to be a vital part of the potential success of the road map.

The TERM stands as a statement on the realities of the Tongan energy situation and attempts to provide a comprehensive plan for the future. The goal of creating 50% of its electricity from RE sources by 2012 was not realised but this lofty goal did trigger review and reform, to be discussed below, which may help the effectiveness of the TERM going forward.

In order to gain an overview of work being conducted to implement the TERM this section will look at projects being undertaken by official partners across two broader areas – capacity building and implementation. This breakdown will help canvas a range of projects under TERM, from RE implementation funded by large national and international bodies to the more theoretical work completed at a policy level to help guide the future of the TERM and attempt to increase its efficacy. It will also help determine where the greatest emphasis is being placed; in the capacity building

[313] "Tonga Energy Road Map 2010-2020," 53.

[314] Ibid, 53-54.

[315] Seifried and Witzel, *Renewable Energy: The Facts*: 204.

sector the literature indicated was of crucial importance or directly to implementation projects. Three of the partners named in the TERM press release are of particular relevance to this research, with those being IRENA, NZAID and the EC.[316] In particular, what role the NZ and EU play in regards to the TERM could help ascertain the type of role most appropriate for them regarding RE promotion throughout the Pacific region. In addition to the focus on those three, this section will look at key development partners currently funding or involved in work directly related to the TERM. Each will be briefly introduced as a way to understand their motivations for participation and in the case of international bodies, the constitution of their membership or funding group.

Capacity Building Projects

European Union

The EU is comprised of 27 member states and provides international aid through the EDF. The Delegation of the European Union for the Pacific is the agency responsible for EU relations with PICs and works under the auspices of the European External Action Service. The commitment to climate change mitigation and the promotion of RE sources by the EU is deep and long-standing, as outlined in the policy framework section of this thesis.

Funding from the EU related to TERM seems to take the form of generalised assistance rather than direct funding of projects or initiatives. Tonga is due to receive US$9.2m for RE development under the 10th EDF, which runs from 2008-2013.[317] An agreement was reached in March 2013 for the EU to provide funds of

[316] "Final Tonga Energy Road Map complete," Government of Tonga, http://www.tonga-energy.to/?p=1208.

[317] "EU Relations with Tonga," European Union, http://eeas.europa.eu/tonga/index_en.htm.

US$8.4m to "support Tonga's national development vision and to improve the financial capability of the government to achieve Tonga's Energy Roadmap policy objectives."[318] The funds will be distributed over a three year timeframe and are targeted to create a higher percentage of RE production and a reduction in grid based power loss within two years.[319] There is no mention of specific EU involvement in projects related to TERM, so it's fair to conclude that funding provided under the EDP and the recent grant are provided to the GoT to be distributed as they see fit.

International Renewable Energy Agency

As mentioned in the previous chapter, IRENA is a relatively new body designed to help simplify the implementation of RE sources globally. Both NZ and the EU are part of the 75 strong membership of IRENA and as a result, looking at the structure and early work of this organisation, particularly its first venture in the Pacific region, is of value to this research. In addition, six member states of the PIF are members of IRENA and a further three are signatories yet to complete the ratification process and become members.[320] At its inception, IRENA was designed to be a co-operative organisation with an open membership emphasising helping those countries where RE could be of most benefit. As a result, IRENA is theoretically an ideal candidate for facilitating the implementation of RE in the Pacific.

Despite this, IRENA has taken on a basic advisory role within the TERM. It has produced a report on difficulties of implementing RETs in the Pacific region from a policy standpoint in which it mentions the organisations assistance in developing part

[318] "EU - Tonga Partnership: Pa'Anga 15 million to Support Renewable Energy and Energy Efficiency," ed. Delegation of the European Union for the Pacific (Suva: European Union, 2013), 1.

[319] Ibid, 2.

[320] "Updates on IRENA Membership," International Renewable Energy Agency, http://www.irena.org/menu/index.aspx?mnu=cat&PriMenuID=46&CatID=67.

of the TERM related to off-grid electricity access.[321] The creation of a separate implementation unit within TPL for managing supply and cost of electricity to these isolated communities is suggested within this document[322] but primarily it is concerned with policy challenges presented by the TERM and the lack of a cohesive institutional approach to energy issues.[323] This report addresses key issues raised in the literature on energy and development, specifically the need for strong institutions and policies for RE implementation to gain traction. It concludes by highlighting the role IRENA can play as an inter-governmental agency related to RE in the Pacific, building capacity within institutions and helping identify RETs which are most suitable for the region.[324] IRENA appears to see the TERM as just a single part of a wider regional programme of RE implementation. As a multilateral organisation not designed to play a traditional funding or management role, IRENA is looking to carve out a niche by putting themselves at the fore of an enhanced political dialogue on issues pertaining to RE. Meetings related to progress made under the TERM have seen consistent attendance by representatives of IRENA[325][326] but beyond this IRENA seems to take a back seat to funding agencies and governments, acting as a facilitator rather than a primary player.

[321] "Policy Challenges for Renewable Energy Deployment in Pacific Island Countries and Territories," (United Arab Emirates: International Renewable Energy Agency, 2012), 19.

[322] Ibid.

[323] Ibid, 20.

[324] Ibid, 23.

[325] "One Year After the Official Signing Ceremony of the 2010-2020 Tonga Energy Road Map (TERM) in Abu Dhabi ", International Renewable Energy Agency, http://www.irena.org/news/Description.aspx?NType=N&mnu=nws&News_ID=116.

[326] "Pacific Leaders' Meet to Discuss Energy Roadmaps ", International Renewable Energy Agency, http://www.irena.org/News/Description.aspx?NType=A&PriMenuID=16&catid=17&mnu=cat&News_ID=306.

Renewable Energy and Energy Efficiency Partnership

The main contribution from this agency has come in the form of a report for the Tongan government on the TERM, which was delivered in November 2012. The Renewable Energy and Energy Efficiency Partnership (REEEP) were commissioned to conduct this investigation in 2010, due to concerns over the pace of progress being made under the TERM. This document gives a good overview of the early stages of the TERM and gives perspective on the relative challenges it faces in the near future. The report focusses on issues at the governmental level, specifically the policy, institutional, legal and regulatory reform required to help the TERM gain traction and allow for progress in achieving its objectives.[327] In the process the report discusses current barriers to implementation of RE sources under the TERM.

The REEEP report specifically addresses the lack of tangible ways of measuring achievement in the original TERM document, which has led to long-term, less tangible goals being substituted in for measurable short-term targets.[328] The establishment of logical milestones is viewed as a way to foster more immediate progress and retain the interest of funding agencies.[329] The current status quo with regards to policy creation and dissemination is rejected as "a piecemeal approach"[330] and strengthening this framework is mentioned as important to the success of the TERM. This mirrors a theme found through the literature on energy and development, specifically that strong policy frameworks are an important precursor to RE implementation.[331][332] The importance of an implementing framework was

[327] Fogarty, "Balancing Energy Reform in the Kingdom of Tonga," 4.

[328] Ibid, 10.

[329] Ibid, 41.

[330] Ibid, 29.

[331] Alazraque-Cherni, "Renewable Energy for Rural Sustainability in Developing Countries " 106.

highlighted throughout this report and the new funding approved from both the Abu Dhabi Development Fund,[333] World Bank and the GoT[334] for the TERM IU during its writing was mentioned as important for the provision of expertise in both the governmental and practical implementation spheres. The report also cautions against spending more time analysing what has caused slow progress to date and implores the TERM Committee to move forward with this set of recommendations rather than creating further delay by soliciting additional or alternate opinions.[335]

The report concluded that a number of measures would help the TERM make progress towards its goals. These included the need to act quickly in order to keep TERM visible and viable to investing agencies, organisational reform that promotes simplicity and streamlining of policies and institutions as well as legal and regulatory frameworks and finally ensuring that the community and TPL are deeply engaged in the TERM.[336] Despite this focus on the need to expedite the implementation process, the REEEP report advocates an approach that places higher importance on creating strong policy than the actual installation of RETs or upgrading of the grid,[337] with a summary stating that "the balance of effort needed to be tipped in favour of organisational reform rather than hardware deployment."[338] This is again in line with the academic work on energy and development which states that strong institutions and policy frameworks are a necessary antecedent to implementation.

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[332] Carbonnier and Grinevald, "Energy and Development," 18.

[333] Fogarty, "Balancing Energy Reform in the Kingdom of Tonga," 34.

[334] Ibid, 28-29.

[335] Ibid, 42-43.

[336] Ibid, 6.

[337] Ibid, 41-43.

[338] "Mapping Out an Energy Reform Pathway for Tonga: Final REEEP Report Handed Over," Renewable Energy and Energy Efficiency Partnership, http://www.reeep.org/news/mapping-out-energy-reform-pathway-tonga-final-reeep-report-handed-over.

World Bank

The World Bank is a group of five investment institutions all under the ownership of its 188 member countries. Sustainable development is a focus for the group and the intersection between RE and quality of life improvement found in the TERM fits with their vision of assisting the poorest countries to develop in a sustainable manner.

The World Bank pledged US$2.9m in July 2012 for a capacity building project within both the TERM IU and TPL.[339] This grant came from two sources, with the Australian Government providing US$2.5m through the Pacific Region Infrastructure Facility and US$400,000 coming from the Asia Sustainable and Alternative Energy Program.[340] The GoT provided the final US$1.1m to arrive at the total US$4m budget for the project.[341] The World Bank grant is to be used to fund almost the entire TPL project, while the GoT is responsible for almost half the funding on the TERM IU side.[342] The project aims to provide technical assistance to the TERM IU in order to improve its overall function and effectiveness across a number of key areas of responsibility, including energy policy, environmental and social safeguards and communication with the wider public.[343] The TPL side of the project is focussed on helping find "the most cost effective way to diversify energy generation"[344] as well as developing strategies to deal with power generation coming from new sources with the end goal of having a five year power system plan.[345] Overall, the goal is to help both the TERM IU and TPL reach a point where they can comfortably and

[339] "Project Paper for Small Recipient Executed Trust Fund Grant US$2.90 Million Equivalent to the Kingdom Of Tonga for an Energy Roadmap Institutional and Regulatory Framework Strengthening Project," 7.

[340] Ibid.

[341] Ibid.

[342] Ibid, 17.

[343] Ibid, 16.

[344] Ibid.

[345] Ibid.

competently handle any new challenges the implementation of the TERM provides them with.

This project looks to address many of the issues raised in the REEEP report, with the strong focus on capacity building within governmental agencies and need for long-term plans and strategies being a common thread between them. The REEEP report placed a lot of importance on the need for an effective implementing agency and mentioned the World Bank funding being directed to the TERM IU as a positive and potentially important move. The success this project has in transferring expertise to those working within the TERM IU and TPL could be crucial to Tonga achieving the type of strong policy framework that would allow for RE implementation to flourish.

Implementation Projects

New Zealand Agency of International Development

NZAID is an aid provision programme run by the NZ Ministry of Foreign Affairs and Trade. The agency provided NZ$562m of funding in 2012[346] and this is primarily focussed on the Pacific region. NZAID has a specific development framework with Tonga, which includes funding related to the TERM.

The first NZAID funded project under the TERM was the installation of the 1MW solar PV facility mentioned in the Tongan JCD, on the main island of Tongatapu. Completed in July 2012, the Maama Mai power plant has provided around 4% of the island's electricity needs since coming online this past August.[347] The electricity tariff

[346] "Aid Statistics," New Zealand Agency of International Development, http://www.aid.govt.nz/about-aid-programme/aid-statistics.

[347] "Maama Mai," Meridian Energy, http://www.meridianenergy.co.nz/about-us/generating-energy/our-power-stations/solar/maama-mai/.

in Tonga decreased once Maama Mai started producing, coming down from just about 90 seniti to just over 85.[348] While this has since risen again due to increasing oil prices, it nevertheless demonstrates the ability for RE installations to have a tangible effect on the price of electricity. NZ state owned enterprise Meridian Energy proposed the project and NZ$7.9m was provided by NZAID to complete the project.[349] In order to ensure the smooth running of the plant, Meridian is retaining responsibility for operation and maintenance until 2017, when ownership will be transferred to TPL.[350] This type of shared responsibility may be significant as a model for ensuring effective and secure supply in the initial stages while still building capacity with workers from within the community and eventually facilitating local ownership. In addition, NZAID is contributing NZ$6m over the next three years to upgrade parts of the grid outside urban centres on Tongatapu.[351] These projects constitute a significant investment in the TERM by NZAID. As the first operational grid connected RE installation completed in Tonga, the Maama Mai plant provides a model for future projects.

Asian Development Bank

The Asian Development Bank (ADB) is an organisation focussed on the reduction of poverty in Asia and the Pacific. Comprised of 48 member states within the Asia-Pacific region and 19 external members, the ADB has a strong emphasis on promoting environmentally sustainable growth, as evidenced by its inclusion as one of three core development agendas in the *Strategy 2020* plan.[352] This was further

[348] "Electricity Tariff Decrease September Bill," Tonga Power Limited, http://www.tongapower.to/OurBusiness/TariffNews/tariff_decrease_September1.aspx.

[349] "Maama Mai".

[350] Ibid.

[351] "Tonga," New Zealand Agency of International Development, http://www.aid.govt.nz/where-we-work/pacific/tonga.

[352] "Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008-2020," (Manila: Asian Development Bank, 2008), 12.

re-enforced in the recently released *Environment Operational Directions 2013-2020* document, which includes explicit mention of increasing importance being given to implementation of RE sources.[353] As one of the TERM development partners, the ADB is funding two projects within Tonga – one focussed on EE and the other on RE.

The Outer Island Renewable Energy Project was funded to implement solar power production capacity on Tonga's three main outer islands – 'Eua, Ha'apai and Vava'u. The long-term goal set out in the project data sheet was for peak production of 0.75MW of solar power supplementing current diesel based supply. Approved in December 2011 for US$725,000, this stage of the project was focused on assessing solar power capacity and identifying potential installation sites on each island, conducting impact analyses and training employees of TPL and providing information to potentially affected customers. This is described as a "capacity strengthening program of executing and implementing agencies, including customers"[354] and is in line with recommendations for education and training in host communities found in the literature featured in chapter two.

Following on from this, in April 2013, the ADB agreed to fund the second stage of the Outer Island Renewable Energy Project to construct the solar power facilities on 'Eua, Ha'apai and Vava'u and connect them to the grid. Total funding was set at US$2.3m, with US$2m coming from the ADB.[355] The project outline re-enforced the commitment to capacity building within TPL and providing information to customers about topics such as energy conservation.[356] Also included within this document is a reference to the possibility of a subsidised tariff, which would allow poorer

[353] "Environment Operational Directions 2013-2020: Promoting Transitions to Green Growth in Asia and the Pacific," (Manila: Asian Development Bank, 2013), 2.
[354] "Outer Island Renewable Energy Project," (Asian Development Bank, 2011), 2.

[355] "Outer Island Renewable Energy Project," (Asian Development Bank, 2013), 2.

[356] Ibid.

households to benefit from any reduction in power costs the solar plants facilitate.[357] No further details are provided but it would be interesting to see if this mechanism will resemble the Renewable Energy Premium Tariff discussed by Moner-Girona in her article on supporting RE in the developing world[358] or if it will be a different type of model more directly focussed on end user electricity tariffs. The report states that local groups will be included in a consultation process to determine issues related to power provision and that this will take a form that allows for broader participation to reach a greater proportion of affected parties.[359] This project is categorised as a high priority project under the TERM and has end goals of successful implementation and sustainable management of solar power installations on each of the targeted outer islands.

The other ADB funded project attached to the TERM is related to EE and was approved in December 2012. It is a US$400,000 project which will work in concert with the RE project discussed above, upgrading the grid systems on 'Eua, Ha'apai and Vava'u and installing solar powered street lighting.[360] These changes are being made in order to reduce the high level of power losses found within the Tongan grid network, which are currently around 15% higher than expected standards for rural power delivery.[361] The upgrades will help supplement the effectiveness of solar power facilities installed under the banner of the RE project while also minimising power losses within the grid by increasing its efficiency and reliability, leading to further decreases in FF use. This phase of the EE project will involve technical support from the same consultancy firm used during the early stages of the RE project[362] in order to determine technical feasibility across all project sites and

[357] Ibid.

[358] Moner-Girona, "A New Tailored Scheme for the Support of Renewable Energies in Developing Countries," 2037.

[359] "Outer Island Renewable Energy Project," 2.

[360] "Outer Island Energy Efficiency Project," 2.

[361] Ibid.

[362] Ibid, 3.

ensure there are no adverse social or environmental impacts from its implementation.

These projects satisfy both main elements of power supply the TERM looks to address. Installing RE capacity is obviously a main goal but the EE project goes to the core of the FF dependency and supply chain issues mentioned in the TERM final report. That these ADB funded initiatives are taking place away from the main island of Tongatapu is significant. While the majority of electricity demand is on the main island, these projects show the comprehensive approach being taken under the TERM and will be important to fostering the type of power cost reduction that was revealed in the literature as a potentially crucial factor in the development of more isolated populations.

United Arab Emirates Government

The United Arab Emirates (UAE) Government has funded a number of external RE implementation projects. Through the Abu Dhabi Fund for Development the UAE is funding a 500 KW solar power plant on the island of Vava'u.[363] Masdar, a company interested in the promotion of RE owned by the Abu Dhabi government, is responsible for organising installation of the plant which began in early 2013.[364] Total investment from the Abu Dhabi Fund for Development is US$5m and the project is due to be completed by the end of 2013.[365]

[363] "Implementation of UAE Grant Funded 500 KW Solar Station Vava'u to commence early 2013," Government of Tonga, http://energy.gov.to/index.php/term/172-implementation-of-uae-grant-funded-500-kw-solar-station-vava-u-to-commence-early-2013.

[364] Giles Parkinson, "Australian Company Building 500kW Solar Hybrid Plant in Tonga," RenewEconomy, http://reneweconomy.com.au/2013/australian-company-building-500kw-solar-hybrid-plant-in-tonga-98211.

[365] Ibid.

Japanese International Cooperation Agency

The Japanese International Cooperation Agency funds a number of projects that are of mutual interest to both Japan and the Pacific region. It's involvement in the TERM is in line with the Japanese government's emphasis on the mitigation of climate change[366] and promotion of sustainable development.[367] In March 2013, Japanese International Cooperation Agency agreed to fund a US$1.7m project for the installation of a micro-grid control system at the Maama Mai solar plant. This system is designed to minimise the impact of fluctuating RE supply on pre-existing diesel generated power, which can cause undue load on the grid and lead to unnecessary damage.[368] This goes towards two of the primary goals of the TERM; ensuring effective supply from RE sources and increasing EE through reducing grid based power losses.

Pacific Energy Summit

In March 2013, the Pacific Energy Summit took place in Auckland, NZ. The summit was co-hosted by NZ and the EU and sponsored by the World Bank, ADB and the Australian Agency for International Development.[369] It followed a Pacific Leaders' Energy Summit in Tonga and was designed to generate substantial funding for projects related to energy within the Pacific. A total funding commitment of NZ$635m was pledged by both public and private sector donors,[370] including the TERM grant provided to the GoT by the EU outlined earlier. This meeting also aimed

[366] "The 11th Informal Meeting on Further Actions against Climate Change," (Tokyo: United Nations Framework Convention on Climate Change, 2013).

[367] "Japan gives $2.95m Pa'anga Grant to Build Micro-grid Control System at Maama Mai Solar Farm," Tonga Energy Road Map Implementation Unit, http://energy.gov.to/index.php/news/199-japan-gives-2-95m-pa-anga-grant-to-build-micro-grid-control-system-at-maama-mai-solar-farm.

[368] Ibid.

[369] "Summit Statement 5 April: Accelerating Renewable Investments in an Energy Efficient Pacific," Pacific Energy Summit, http://www.pacificenergysummit2013.com/about/summit-statement-5-april/.

[370] Ibid.

to foster dialogue on Pacific energy issues and co-operation between public and private sector organisations for the promotion of RE.

This summit is of particular interest due to the fact that it was hosted by NZ and the EU and also included other core TERM partners. Both NZ and the EU taking a lead role in a high level conference such as this re-enforces each in their respective roles; NZ as a leader in the Pacific region and the EU as a leader on RE and climate change mitigation globally. The way both have operated within the TERM shows how they feel they can be most effective. For NZ, funding specific projects around RE implementation and EE improvement and utilising state owned enterprises to carry these out takes advantage of their proximity to the region and the expertise present in NZ due to its early uptake of RETs. For the EU, providing broader assistance at the governmental level allows it to stay involved from afar and use political dialogue as a way to legitimise itself as a player in the global arena. Seeing their participation in the TERM take this course is unsurprising as it allows both to have an impact while not straying from their own agenda.

With over a third of the TERM implementation period passed, this experiment in marrying the climate change related RE promotion goals of developed partners with the societal need for reduced energy tariffs in the developing host country is at a crucial juncture. The number of partners and quantity of funds available to the GoT for the implementation of the road map are plentiful and are directed at a number of areas that could have a tangible benefit to the Tongan people. Nevertheless, the lack of a strong institutional framework led to policy, regulatory and legal issues delaying the progress of the TERM. As is indicated in previous work on implementing RETs in the developing world, having expertise at the governmental level allows for these strong policies to exist and provides a strong basis for projects in new areas such as RE. For PICs, this type of expertise requires the type of capacity building advocated in the REEEP report, through appropriate external agencies. The ability for capacity building projects, such as the World Bank funded initiative, to facilitate

effective knowledge transfer and create local investment in RE implementation will be central to the implementation of the TERM.

Tonga has a number of conditions which make it a strong candidate for RE implementation. The presence of a single energy provider supplying 85% of the population with grid based electricity is something not many PICs can lay claim to. There is extensive infrastructure, so projects in that area only need improve on what is already present, rather than undertaking the expense of creating new electrical networks and resources. The intermittency of currently viable RETs means variability of supply has to be taken into account but at this stage there is still considerable room for solar PV and wind derived supply in Tonga's energy mix, as well as the potential of landfill gas and coconut oil as a source of power in the near future. Thus far this has not been the case but if the institutional hurdles that currently slow the progress of the TERM can be cleared, there is no reason it cannot be a successful experiment as well as one that can have numerous lessons for other PICs considering a similar path. It may not meet all of its goals, but the TERM can show the viability of using RETs to help mitigate the energy issues that currently inhibit the Pacific region's development.

Chapter Five: Conclusion

The goals of this research were to gain better understanding of the potential efficacy of RE as a development mechanism, as well as how NZ and the EU could be involved in the implementation of these sources. The literature review chapter looked to explore the first part of the research question, the policy framework was more focussed on the second component and the case study was designed to look at both parts equally in a practical context.

The literature review considered a range of sources that could contribute to a better understanding of the importance or energy in the development domain and what role RE had to play in this regard. The scope narrowed throughout this chapter, beginning with a general examination of energy and development before considering RE first in the context of the developing world generally and then in regards to SIDS and the Pacific region. The broader look at energy and development in this section was intended to give a basic overview of energy sector issues in the developing world and the obstacles they present. One clear strand of thinking that came through in this regard was that the high price paid for electricity in developing countries, along with its insufficient and inconsistent supply, constituted a significant barrier to improving living standards and attempts to eradicate poverty. The consideration of RE in the developing world included analyses of specific mechanisms for implementation as well as implementation in rural and isolated populations, a subject of particular relevance to the Pacific region. Initial works considered in this section highlighted both the long-term economic benefits of RE use as well as the short-term expense that presents a challenge to more widespread or large scale implementation in the developing world at present. When considering the mechanisms used for RE in developing countries, the CDM was the one most prevalent in the literature. Analysis of the CDM revealed that large scale projects were favoured for their potential to provide more CERs to the implementing country, which lead to a bias towards ventures being conducted in larger developing nations. This means that the CDM, despite its prominence in the academic and political dialogue on RE implementation, might not be an effective tool in the Pacific unless the method of rewarding countries funding projects is adjusted. When considering

RE in a rural and isolated community setting, an emphasis on electrification emerged. Several works in this subsection discuss RE as a potential solution to lack of electrification in areas where grid extension is impractically expensive. Some of these go further and suggest methods or organisations that would be appropriate to help create a balance between on-grid and non-grid sources. The final section of this chapter focusses in on RE implementation where it is of most interest to this research; in SIDS and particularly those within the Pacific region. Articles here discuss challenges faced by SIDS, including lack of FF resources, cost of transporting fuel to outer islands and the aforementioned lack of support under mechanisms like the CDM for smaller developing countries. The importance of providing training to locals to help ensure community involvement in RE projects is a constant in this section, as a way of increasing the chances of long-term successful implementation. Overall, this chapter provides an overview or what makes energy important to development, why certain conditions make RE a theoretically suitable solution to issues in this sector and the barriers that have prevented that solution from already coming to fruition.

When looking at the policy framework in place between both NZ and the EU in regards to the Pacific region, the basic goal was to better understand how interaction occurs and whether RE was an area of emphasis in these relationships. In order to do this, it was important to first discover what level of importance RE was given within NZ and EU internal policy and whether either or both considered it an area of competence. These internal policy documents showed that the EU gives a lot of prominence to RE as part of its climate change mitigation focus, setting ambitious targets for its member states to meet while acknowledging the cost and policy issues that still exist. The analysis of two NZES texts shows a reducing focus on RE over time, with static targets but rhetoric emphasising balance over RE promotion. The next important step was to define how the EU works with the Pacific region in a multilateral manner, as it is wont to do, and what political and funding linkages between the two exist. The primary organisation the EU deals with in regards to the Pacific region is the PIF, which itself has internal policies including

limited RE content, with political dialogue most frequently occurring through the long-standing EU-ACP relationship and funding coming from the EDF. The RSP and CSPs for the Pacific were particularly interesting, with the majority of CSPs including RE commitments and funding. NZ's relations with the Pacific were far simpler, occurring primarily through its aid programme on a bi-lateral, country to country basis through JCDs. Finally, two new organisations were introduced which might contribute to political relations between both NZ and the EU with the Pacific region in the future. In considering these various new, old and current relationships, this chapter provided a basic understanding of how interaction occurs with the Pacific region from the NZ and EU perspective.

The case study aimed to bring the perspectives gained from the literature and policy examinations and see how they are applied in practice within the TERM. Looking at the document itself reveals an ambitious set of goals and a thorough commitment to RE as a means of dealing with Tonga's energy issues. Following this, the main focus was to see which projects were getting funded and by whom. Considering which official development partners under TERM were funding projects and in which areas these were occurring allowed for a greater understanding of the method of RE implementation in the Pacific context. The two basic project types were capacity building and implementation, with funding agencies coming down neatly on either side of this divide. On the capacity building side, two of the organisations that were of the greatest interest to this research, the EU and IRENA, fulfilled separate roles. The EU provides generalised assistance to the GoT to increase the financial capacity of Tongan institutions while IRENA thus far has been confined to an advisory role, helping with policy formation and analysing the challenges of RE implementation in the Pacific more generally. Along with these two, the REEEP provided a comprehensive report on what was delaying process in the early stages of the TERM and how to correct this in the future, while the World Bank is funding a project to build capacity within both the TERM IU and TPL. On the implementation side, a project funded by NZAID has already resulted in the construction of a solar power plant which is currently operational on the main island of Tongatapu and a follow up

Japanese International Cooperation Agency initiative will help manage this new supply in an efficient manner. Projects from the ADB and UAE government are in the process of creating solar power capacity on Tonga's outer islands. All these projects show the strong commitment and willingness to invest that exists from the development partners of the TERM. This was further re-enforced at the Pacific Energy Summit, where a large amount of funding was secured for projects across the region. The fact that NZ and the EU co-hosted this event was an important indication of the leading development roles they see for themselves in the Pacific region. These roles are both of importance but are not particularly similar. For NZ, working within the political apparatus of the Pacific region gives a perspective and proximity that allows for a more hands-on approach. The EU on the other hand, has strong and varied ties to the region which allow its weight to be felt more from a financial point of view, as a primary provider of aid. This case study of the TERM illustrated how policy and theory are applied in real world settings. It showed that there are on-going attempts to clear the administrative hurdles faced in Tonga but that they haven't been totally successful as yet. Nevertheless, the conditions exist within Tonga for the TERM to be successful and the commitment, financial and otherwise, from its development partners has not wavered. This model still constitutes a significant experiment for the Pacific region, as despite the fact that all PICs do not share the qualities that make Tonga an appropriate test case, they all share the same reliance on FF production and need to find a way of circumventing this.

The sum total of these three analyses is a broad overview of the theory and political practice of RE implementation with regards to the Pacific region. Throughout, three key themes came to the fore. First, energy is unquestionably of crucial importance to development. The literature reviewed placed heavy importance on energy provision and cost as a driver of improving living standards and this was mirrored within the policies of both NZ and the EU towards the Pacific region. Whether it was regarding electrification, EE or RE, energy considerations were built into NZ and EU policies both internally and externally with only rare omissions within the Pacific CSPs and

JCDs.

Second, the need for strong political capacity to support RE implementation was a constant element of the academic works considered in this thesis. This was re-enforced by the emphasis on improving institutional strength and governmental standards in EU-Pacific relations through the *Cotonou Agreement* and by the projects in the sector being funded under the TERM. As the REEEP report outlined, lack of experience and expertise in the policy, regulatory and legal spheres within relevant institutions can interrupt progress on RE implementation. Beyond this, there is a need for policy to support and incentivise RE projects given their high start-up costs and unfamiliarity to the companies and communities that will be affected by them. In essence, PICs need strong policy to promote implementation, strong institutions to enact that policy and strong regulatory and legal frameworks to allow that implementation to create tangible benefit.

The final theme was that of community engagement as a way to improve the long-term efficaciousness of RE projects. The academic work on RE in the developing world highlighted cases where insufficient education of local customers and training of local workers made initially successful projects fail due to poor maintenance and the resulting lack of acceptance by the host community. This also goes to a core principle of development theory, whether the process is best conducted from the top down or from the bottom up. The literature was clear and consistent on the need for locals to be involved in the construction and maintenance of new energy supply infrastructure, but this was not as constant in a policy or project funding sense. Again, Tonga seems to be a leader in the Pacific region, this time in terms of specific initiatives to train locals for projects in the energy sector. The Tongan JCD included a goal of training local linesmen, the TERM IU has specific responsibilities related to the training of local staff and the ADB RE project in the outer islands includes provisions for the training of TPL workers and involvement of the local community. In a deeper sense, consulting with the communities likely to be affected by RE projects before and during the process of implementation and involving locals in the

running and repair of facilities afterwards, you can foster the type of deep investment that will lead to more widespread adoption and acceptance of the new technology in the future.

These three themes came through clearly as areas of importance to the efficacy of RE implementation. The first provides the basis for its potential value, the second lays the groundwork for the initial stages of implementation and the last helps improve the chances of lasting success. While issues surrounding the cost and supply of electricity will remain as such until action is taken, the other two are areas where NZ and the EU could and will attempt to play a key role. How effective they can be in generating real progress and improving the chances of RE being an effective mechanism for development is an open question but there is undoubtedly a theoretical basis for what is being attempted and the TERM is a fascinating test case for this in the Pacific context.

The materials considered in this thesis were effective in delineating those three themes but there were also limitations that arose from scope of this research. The focus on policy documents as a means of understanding how interaction occurs and action is initiated with regards to energy in the Pacific helped provide valuable context for the question of whether RE can be a useful development mechanism in the region. However, the policy considered was from a NZ and EU perspective, with internal policy as it relates to the Pacific only being considered at a regional level. The linkages to different PICs from both NZ and the EU occurred through cooperative documents but these still didn't illustrate the issues encountered in these states in as much detail as internal policy would. Looking at how individual energy policies in the countries of the Pacific region emphasised issues such as cost, electrification and security of supply in comparison to RE would show where it is on their political agendas. Finding out this type of information could help to indicate whether RE promotion in the region is a purely external push or whether, at this point in time, PICs see its potential benefit and are actively seeking to have these new sources become a part of their energy mix. This added dimension would have

given even greater context to the policy frameworks that exist in the Pacific region with regards to RE.

The academic work reviewed in this thesis provided the basis for the theoretical benefit of RE in the developing world. First by demonstrating the link between energy and development and then by illustrating how RE could be utilised to help solve the energy issues holding developing countries back, this section constituted a large part of the answer to the first part of the main research question. Broadening the scope here to include studies of previous NZ and EU development programmes and initiatives would have allowed it to fulfil a dual purpose, identifying the problem and potential of RE as a solution but also demonstrating whether NZ and the EU would be the right partners to promote this solution in the Pacific region. There is no doubt that NZ and the EU see themselves as playing a leading role in the development of PICs, which is reflected throughout their policies and funding commitments, and this indicates what part they will likely play in RE implementation in the region. However, without an analysis of the historical efficacy of NZ and the EU in the development sphere, this research cannot answer the question of whether they are best suited to the roles they will take.

Policy and academic texts were defined as the scope of this research in its initial stages and the myriad of documents relating to the topic have certainly helped provide answers to the research questions of this thesis. Despite this, there is likely more depth of knowledge available than is contained in these two areas, particularly when dealing with the developing world, where academic work and policy expertise tends to be limited. Expanding this research to include news media sources from within PICs could have granted access to some of this additional information and allowed for a more comprehensive view of RE and its relevance and value in the region. While opting for depth within the academic and policy domains provided the type of information that could satisfy the questions of this research, considering a wider range of sources could have helped answer more fundamental queries about the practical aspect of RE implementation, expanding the scope of the research in

the process.

A more practical perspective on RE implementation in the Pacific could have been gained by taking a more technical approach. Looking more deeply at the efficiency of different RE technologies could have helped show why RE implementation in the Pacific is heading down its current path as well as illustrating what different options may be more appropriate in the future. Factors such as the initial cost of RE installations and intermittency of supply complicate its use as a solution to Pacific energy issues, so taking research on advancements in various RE industries into account could have led to more prescriptive rather than descriptive conclusions.

Another option for expanding the scope of this research and undertaking a more exhaustive look at RE implementation in the Pacific would have been to collect primary data. Conducting interviews with experts on the Pacific region or energy as it pertains to development could have led to more complete answers to the questions of this research as well as opening up avenues for further study. As with the option of broadening the range of secondary sources utilised, committing to the collection of primary data would likely result in a larger research project that would alter the main enquiries of this thesis. In this sense the narrow scope of this research helped retain clarity and focus on the research question, where creating and considering other information might have lead it down a different path.

The sources in this thesis all show that RE can have a significant impact on development in the Pacific region given the right political and societal conditions. They also show that NZ and the EU will likely play a large role in attempting to affect this change in the energy realities of PICs in the near future. A lack of theoretical and political impetus for RE implementation in the Pacific is not what will prevent it from happening, if anything does. The importance of strong policy and community support of RE projects and inability thus far to satisfy these conditions begs the question of whether RE implementation will be able have an impact on Pacific development. As a result, considering which international actors are best placed to

help PICs meet these political and societal conditions is of great importance. This group may indeed include NZ, as a member of the region whose aid programme is directed primarily at PICs, and the EU, with its large aid budgets granting financial flexibility to countries who don't usually possess that luxury, but a deeper analysis would need to be conducted to assert that. This is a logical area for future research following this thesis.

A more fundamental line of research can also emerge from the fact that RE is a potentially impactful development tool that is not yet having a significant effect. As mentioned above, discovering which agencies are best suited to moving RE implementation from theory into practice could be significant to its future as a development mechanism but in addition to this, looking into what conditions were necessary for new technologies to take hold in the developing world historically could help show where RE implementation efforts should be targeted. Full penetration of modern transportation and communications technologies, appliances and general infrastructure is certainly not common in the developing world but there are cases of each to be found and these might prove useful in reference to RE. An example in the Pacific region is the diesel generators that are currently relied on for energy supply. What conditions allowed for the eventual widespread use and acceptance of diesel generators and whether any of those can be applied to the current situation with RE technologies would make an interesting study.

Following on from this, research into what constitutes strong policy for development and how best to produce this could be useful in the Pacific and broader developing world context. The need for policy to support and incentivise RE implementation was a point of emphasis within the literature on RE and the developing world, so identifying relevant examples and gaining a better understanding of how these were formed could be of value. Whether these policies relate to RE or not, looking at how countries have used these instruments to drive their development would help define what types of capacity building approaches have been most effective in the past. Whether the formation of policy occurred with direct external assistance or was

generated after internal levels of expertise rose would be another interesting factor to consider as it relates to the current attempts to implement RE in the Pacific. While this research described the need for effective policy to promote development, practical work on what form this has taken in the past and should take in the future would potentially benefit not only the Pacific region as it relates to RE but also the developing world more generally.

In order to further investigate the political dimension of RE in the Pacific, surveying of both the political elites and their constituents to see what level of importance is placed on this subject would be useful. This information could allow for a better understanding of how RE is seen at both a governmental and societal level; whether the link between the energy issues within PICs and RE exists in the mind of the public and how high of a priority this is politically. Strong policy and an engaged community were raised throughout this research as important indicators of the potential success of RE implementation, so gaining this type of fundamental understanding of the current public perception within PICs would be invaluable.

While this research focuses on public sector agencies in the promotion of RE in the Pacific, an investigation of the role private sector groups are playing in this domain would be intriguing. Private sector donors were a significant part of the Pacific Energy Summit and seeing what form their contributions take could be of value to understanding how RE implementation in the region might take shape. Private sector organisations also have a role to play as the bodies employed to execute projects funded from the public sector and how effective the communication of goals and provision of funds is between these organisations can have a tangible effect on how effectively a project is implemented. Further investigating Sovacool's assertion that PPPs can help overcome the weaknesses of both the public and private sector's approaches could help identify a model of best practice for RE implementation in the Pacific. A study on the role the private sector has to play in RE use in the Pacific and the interaction with public sector funding and management bodies would add useful information to the knowledge base that exists in this area.

The literature review also raised the issue how to utilise the CDM in smaller developing countries. A study focussed on the conditions that make larger developing countries more attractive hosts for projects under this scheme and what alterations might make it more universally valuable would be interesting as it pertains to the Pacific region. At present, the CDM is of minimal benefit to PICs and better understanding why this is the case and what can be done to change it could have a significant impact on RE implementation in the region.

The limited scope of this research created a number of opportunities to extend its focus and highlighted a numerous branches for further research. Nevertheless, this limited scope also allowed for a detailed look at academic and policy texts which demonstrate that RE can have a basic cost and energy supply benefit in the Pacific region. The comprehensive political ties between the EU and the Pacific both presently and historically show that there will continue to be a strong European influence in the Pacific despite the geographical detachment of the two regions. NZ-Pacific bonds are a constant due to its geographic presence and political standing within the region. The fact that it was the first country to successfully fund, construct and produce electricity from an RE power plant under the TERM illustrates how the combination of expertise and proximity makes it a potentially effective actor. The TERM itself is an important test case for RE implementation in the Pacific region. Following its progress over the 10 year period it covers will be absorbing but it is of equal importance to see how management and maintenance of capacity at both a political and practical level endures following its expiration.

The Pacific region provides both unique opportunities and challenges to RE implementation. As a region reliant on expensive FF sources of power and with a majority of its populous not having access to electricity, it presents itself as an ideal candidate for RE use. Additionally, the low levels of consumption make facilitating a perceptible shift in PICs energy mix a theoretically achievable goal. Despite this, the conclusions of this thesis show that the path to RE implementation is unlikely to be a

direct one. However, if certain preconditions can be met, it is entirely possible for RE technologies to swiftly have an appreciable positive effect on the Pacific region's energy issues.

The ability for this positive effect to be realised hinges on two key variables. Improving access to energy and reducing its cost has been demonstrated as an effective way to facilitate development. External political impetus and funding is not in doubt with regards to RE promotion in the Pacific region so it essentially comes down to internal political and social considerations. If the assertions contained in the works considered by this research are accurate, the importance of creating strong internal policy frameworks within PICs and increasing the efficacy of their institutions cannot be overstated for the implementation of RE technologies. Fostering strong ties to RE projects within the local community, both through personnel and potentially affected consumers, is also seen as crucial to the long-term potential success of these initiatives. Without deep co-operation between implementing agencies and host countries, the momentum necessary to overcome the high setup costs of RE technologies might not be generated. As a result, how much consideration is given to these two factors will be vital to whether RE sourced power can become a significant part of the Pacific region's energy mix and how effective it can be as a mechanism for development in the future.

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